THE

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REMOVE THE MASK!

READERS of the ELECTRICAL REVIEW are quite familiar with our warnings concerning the intentions of Teutonic traders to make every possible use of facilities, both ordinary and extraordinary, that may present themselves in neutral countries for re-establishing their foreign trade connections with peoples with whom they are now at war. Quite early after the outbreak of hostilities, both to the official and to the commercial mind, there arose the difficulty of discovering whether goods imported from neutral countries were actually made there or were of enemy origin. There was the genuine desire to cut off transactions absolutely, but often there was the suspicion that, though complete evidence was lacking, the apparently Dutch, Swiss, or Swedish manufactures were in reality German. In certain cases experts familiar with special lines of goods were able to detect distinctive characteristics, and sometimes in this way even marks of origin were discovered after camouflage had been removed. Since then much has happened to render enemy scheming of such a kind inoperative, and we need have little fear that during the war he will be more successful. But there is undoubtedly serious need for the post-war dangers in the same connection to be provided against. We have no desire to increase the trading difficulties of friendly neutral nations, but it is useless to conceal from even the most legitimate and the least suspected neutral firms that they must remain to some extent under a cloud, unless in the most definite and convincing way they are able to show to impartial, yet representative, parties that they are all that they should be in respect of freedom from enemy connection or taint. Nobody knows better than they do themselves that, however full may be the financial, statistical, personal, and other information that they furnish to prove the cleanness of their hands, there will always be somebody who will remember something about the past. Perhaps he has seen their frank advertisements in the German or international, or even the British, Press in the days of pre-war "innocence," which have enabled investigators to prove the character of their connections. Or, perhaps, a reader of the ELECTRICAL REVIEW may remember, and may turn up in his bound volumes, some reference or other to statements in German company reports, German chairmen's remarks regarding international operations and transactions, of which we made a special feature for our readers' information for many years before the war.

Parenthetically, we may remark that our record has been of particular usefulness in some interesting directions, and no doubt such information will be turned to again and again both during and after the war. In addition to the published material, there is a good deal of knowledge of foreign traders' doings here which never found its way into print, but is in the minds of men to-day, and it plays no less important a part in encouraging their antipathies, their prejudices, and their suspicions. Neutral firms—genuinely neutral as well as nominally neutral—will find it difficult to live down suspicions and prejudices, and purchasers of their goods, too, will lay themselves open to the charge of anti-national trading susceptibilities, unless the air can be absolutely cleared. The neutral firms know

it quite as well as we do, and we suppose recognise it as one of the penalties of neutrality during a war in which German propaganda, influence, and money have been very freely employed in neutral countries.

The situation is one of some delicacy and of extreme difficulty, and while we are ardent in our desire to raise every reasonable barrier to prevent enemy manufactures from finding their way into England, either on a small scale or on a scale to swamp our own interests, we desire that we shall do nothing more than is absolutely unavoidable in the way of imposing injustice from British sources upon those who in sympathy are really interested in the securing of the principles for which the Allies bleed and die, but who have not seen fit to enter the conflict. What we feel is that something is necessary, something more than exists at the moment, which shall enable British buyers and British manufacturing organisations to have open to them "the whole truth and nothing but the truth" concerning the capital, personnel, organisation, international connections, and so forth, of those who call themselves "neutral manufacturers." It is sometimes said: "The Government Departments are satisfied concerning so and so; that ought to be good enough for me!" Well, we are not sure that it has always been good enough for us, for efficient as some Government Departments have been, it has not happened in every case that they have had access to *all* the information that ought to be studied before giving a decision. We believe that the Departments responsible for such matters have a very much better grip of the whole subject than they had some time ago, and their black lists are extremely useful and entertaining, though the full meaning of the connections that they reveal is not always written on the surface for easy comprehension by the uninitiated. We are now getting on with the war, and while the end may be far off, still we shall do well to consider whether the possibility of a good deal of wasteful discussion and bickering and after-war investigation concerning *existing* alleged neutral undertakings cannot in some way be avoided by setting up some sort of impartial International Traders' Tribunal, which shall both clear the air for those who are legitimately entitled to be classed as non-enemy, and shall enable industries to keep a very close watch for developments which may bring German and Austrian influence into the bodies of those concerns which may to-day be beyond reproach.

In the foregoing we have not been discussing the question of economic policy, or of boycott. These are large matters of themselves. What we are discussing is purely and simply the difficulty of ascertaining whether an article is actually of German or of neutral origin, and of being absolutely certain whether an alleged neutral manufacturer or exporter is in fact such. Let there be no doubt about it, whatever trade policy may evolve from the new relationships that ensue from our companionship in arms with the States, the sentiment of civilisation is going to be against the Hun and against his product for many a long day. And until that period is past the average buyer and user will in consequence want to be assured that what he buys is untainted, and that the manufacturer or factor of it is either entirely free from enemy interest or is connected in such infinitesimal proportions as to render him unobjectionable. We really seem to need a thoroughly organised commercial detective agency with some veritable Sherlock Holmes to render service in special cases.

The Wrenbury Committee, which has recently reported upon the amendments in the Companies Acts that are rendered expedient by the circumstances of, and arising out of, the war, has made certain recommendations respecting means by which disclosure will be obtained of alien interest in companies occupied with "key" industries, and by which alien holding, when discovered, shall be compulsorily reduced. It is recognised that a company formed to carry on one class of business may later manufacture "key" products, and so close scrutiny of developments will be essential. Though we are not directly dealing with this report now, the matter is immediately related to the question of neutral concerns abroad, for these may find it policy to establish and register themselves here in some form or other. The Wrenbury Committee advocates certain legislation, and we hope that whatever may be necessary in that connection will be carried just as soon as the Government finds the war position sufficiently established to enable the broad lines of international trading relationships to be laid down.

Wanted, a Book.

One of the commonest of the many queries that are constantly being addressed to us is the request to name the best book, or books, on certain subjects; during the war, contrary to what we should have expected, the number of inquiries of this nature has markedly increased, and we do our best to comply with such requests, though it is not always possible to spare time for the research which would be necessary in some cases. But only too often there is no book available to meet the specified conditions; *e.g.*, if we are asked for a book on electric welding, on present-day methods of electro-culture, or on the latest types of magneto, we are at a loss to name one. If any reader knows of such, published within the last three or four years, we shall be glad to hear from him.

The foregoing examples are quite legitimate inquiries; there should be, and no doubt very soon will be, specialised treatises on all these subjects, as well as on other recent developments. On the other hand, not a few inquiries are received which plainly indicate that the querist has been put in charge of work which he is not competent to perform, and that he seeks to make good the defects of his technical training by reading up the subject—a forlorn hope in matters which call for personal experience or manual dexterity.

One question in particular, however, which we regard as perfectly reasonable, relates to the installation and wiring of alternating-current apparatus. We are acquainted with several useful works which deal more or less fully with A.C. work, and which are admirably adapted for certain classes of readers, but we have not yet met with a book of which the contents fill the requirements which we have in mind. The use of polyphase currents is rapidly extending in this country, and is destined to experience an immense expansion; many electrical fitters and wiremen who are thoroughly at home with D.C. apparatus are being called upon to tackle A.C. motors and switchgear, but are past the age at which they can usefully study A.C. theory, or lack the mental equipment which would enable them to profit by it. What we have in mind for this class of electrician is a simply worded, lucidly phrased little handbook, designed to tell them just as much as they need to know in order to set about such work intelligently and with confidence. There should not be a sine curve in the book, unless it be in an appendix provided for the use of those who care, and are able, to pursue the subject into its more abstruse aspects. Special emphasis should be laid on all the points in which A.C. practice differs from the methods suitable for D.C. work, such as the effect of laying a single cable in an iron pipe, running circuits near unspiralled telephone wires, &c.; and the difference between three-wire D.C. and three-phase three-wire supply, the starting arrangements of A.C. motors of all usual types, the necessity of connecting transformers in parallel with due regard to polarity and phase rotation, should be explained—but all without excursions into technicalities beyond the capacity of the class of reader that we have in view. It may be a difficult problem to produce such a work, but we believe it can be done effectually, and we know there is a need for it.

We may be told that this proposal is heretical—that in order to handle alternating currents rightly, it is essential to be instructed in the theory. We don't believe it. Anyone can use a watch, without knowing anything about moments of inertia, the resilience of springs, methods of temperature compensation, &c. There is too much mystery about alternating currents, due to the over-zealous efforts of its exponents to impart too much information to the tyro. Electrical engineers, certainly, must be fully conversant with the whole theory of alternating currents, but the electrical artisan no more requires such knowledge than the engine fitter requires to know Carnot's theorem, or the nature and significance of entropy. We want a book with no mystery about it.

GRAPHICAL METHODS FOR RESISTANCES IN PARALLEL.

By W. T. MACCALL, M.Sc., A.M.I.E.E.

The best-known method for determining the combined or joint resistance of two resistors connected in parallel is that shown in fig. 1. In this A B is a straight line of any convenient length, A C and B D are drawn at right angles to A B, and represent to the same scale the values of the two

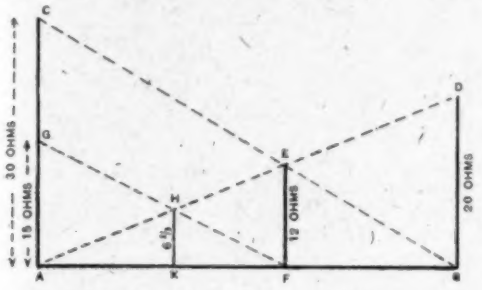

Fig. 1.—Scale: 1 in. = 20 ohms.

separate resistances (30 ohms and 20 ohms in the figure). A D and B C are joined, cutting at the point E, and E F is drawn perpendicular to A B. Then E F gives the value of the joint resistance to the same scale as that used for the separate resistances. Moreover, A F represents the percentage of the current carried by resistance B D, and B F that carried by A C if A B represents 100 per cent.

In this and the other constructions given below, the case of three or more resistances in parallel can be dealt with by successive applications of the method; the joint resistance of two is obtained, and this is then combined with the third resistance in the same manner, and so on for any number.

With the above method it is convenient to mark off the value of the third resistance along the line used for the first resistance (as A G = 15 ohms in fig. 1). Then join G F cutting A E (which is already drawn) at H, and draw H K perpendicular to A B. Then the joint resistance of the three resistors is given by H K; in the example taken, 6⅔ ohms is obtained as the joint resistance of 30 ohms, 20 ohms, and 15 ohms in parallel.

It is preferable, but not necessary, to take the resistances in order of magnitude, starting with the largest. The construction is simplified by using squared paper.

A joint resistance scale which is, or, at any rate, was until recently in use by the G.P.O., is shown in outline in fig. 2.

The complete scale is given in Preece and Stubbs's "Telephony," 1st edition, p. 485, and its principle is partly explained on p. 164 of the same book. It is double the size of that shown, and is marked in 1-ohm divisions.

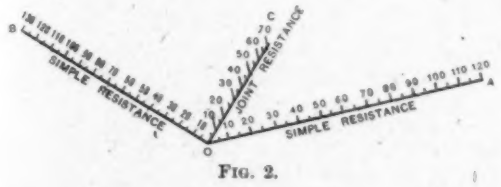

Fig. 2.

It is used by placing a straight edge on the value of one resistance on the right-hand arm (O A) of the scale and on the value of the other resistance on the left-hand arm (O B). Then the point at which the straight edge cuts the third scale (O C) gives on that scale the value of the joint resistance. The scales of ohms along O B and O C are equal, while that along O A is $\sqrt{2}$ (= 1·414) times as big as the other two.

This second method is a particular case of the following general method: Let O A, O B, O C (see fig 3) be any three straight lines radiating from a common point O. Then, if a point D is taken on O A, and a point E on O B, so that O D, O E represent any two resistances, R_1, R_2, to the proper scales, and a straight line D E is drawn cutting O C at F, then it can be proved that O F represents on the corresponding scale the combined resistance of R_1 and R_2 in parallel. The scales used must be such that if a, b, c are the number of ohms per unit of length along O A, O B, and O C respectively, then—

$$a \sin B O C = b \sin C O A = c \sin A O B.$$

It follows that if F G be drawn parallel to O B, and meeting O A at G, then O G represents the combined resistance to the same scale as O D represents R_1. For O G/O F = sin O F G/sin O G F = sin F O B/sin (180° − G O B) = sin B O C/sin A O B = c/a. Therefore, a . O G = c . O F, *i.e.*, O G and O F represent the same number of ohms on their respective scales.

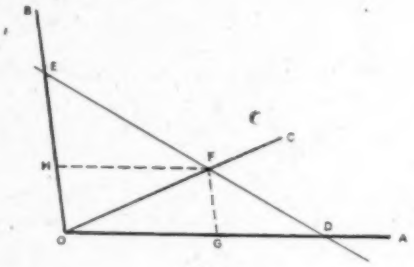

Fig. 3.

Similarly, if F H be drawn parallel to O A, and meeting O B at H, then O H will represent the combined resistance to the scale used along O B. Thus by the use of one or other of these further constructions, the need for a scale of

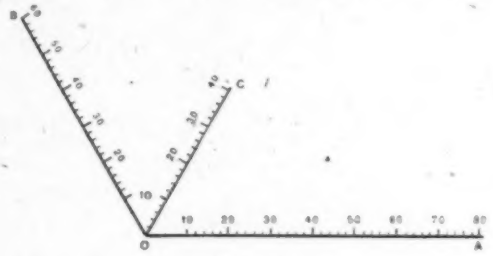

Fig. 4.

ohms along O C is avoided, but the method of using the set of scales is made less simple, except in some special cases (see below for example). An alternative application of this

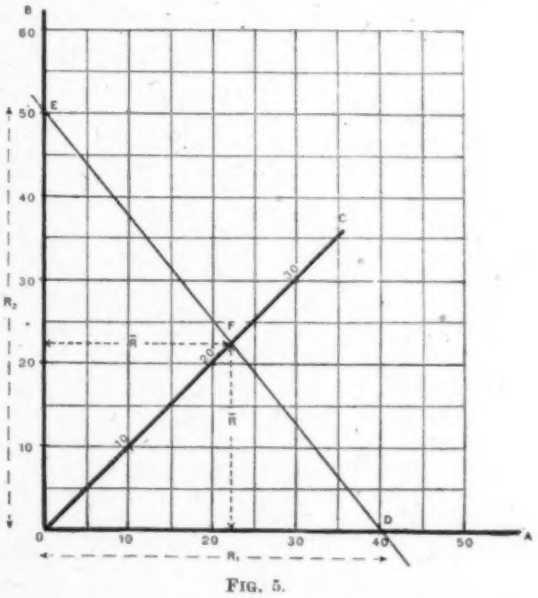

Fig. 5.

relation is to determine the scales graphically instead of by calculation from the above equation. For, since O F, O G, and O H all three represent the same number of ohms to the

corresponding scales, one scale may be taken of any convenient size, and the others can then be found by drawing lines like F G and F H in fig. 3.

Three special cases of this general method may be noted in addition to that already given in fig. 2. Firstly, if each of the angles A O C, C O B be made equal to 60°, which can easily be done with a compass, then the scales of ohms along O A, O B, and O C are all equal, see fig. 4.

Secondly, if each of the angles A O C, C O B be made equal to 45°, so that A O B is a right angle, see fig. 5, then the

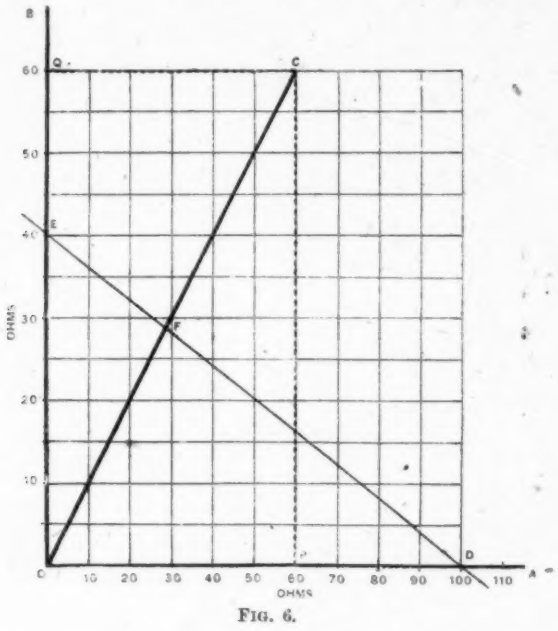

FIG. 6.

scales along O A and O B are equal, while that along O C is $\sqrt{2}$ (= 1·414) times as big; compare this with the second method, fig. 2. But if the lines are drawn on squared paper there is no need to have a separate scale for O C, since the combined resistance, R, can be read off parallel to either of the scales O A, O B used for the separate resistances R_1 and R_2.* In fig. 5 the straight edge D F E is shown adjusted to

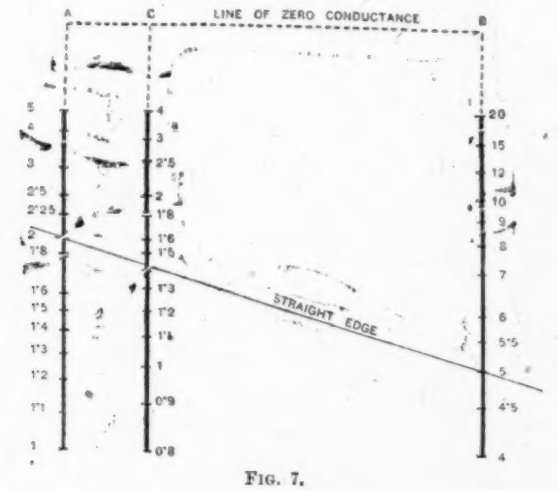

FIG. 7.

find the joint resistance of 40 ohms and 50 ohms in parallel and giving 22·2 ohms as the result. This is an example of the general method mentioned above for reading off the joint resistance.

Thirdly, if the angle A O B is a right angle, and squared paper is used, any two different scales may be taken along O A and O B respectively, the sizes of these scales being chosen so as to be most convenient for the resistances under consideration. The position of O C is settled by taking the points representing the same resistance on the two scales (P and Q in fig. 6) and finding the intersection, C, of the vertical and horizontal lines through these points. O is then joined to C.

In using such a diagram the result can be read off on either the scale along O A or that along O B. Obviously greater accuracy is likely to result if the larger scale is used. In fig. 6, D F E represents the straight edge, and the joint resistance of 100 ohms and 40 ohms is obtained as equal to 28·6 ohms from the point F. The scale of ohms along O B is twice as large as that along O A.

Another way of dealing with the problem is to utilise the fact that the joint conductance (reciprocal of resistance) is the sum of the separate conductances. An "adding nomograph" or "alignment chart" or "abac" may then be employed, with the scales marked in resistance values instead of conductances (see fig. 7). A number of interesting points arise with regard to the methods of obtaining convenient scales; but for the present it may suffice to note the following in connection with the example given. It is suitable for cases in which one resistance lies between 1 ohm and 5 ohms and the other between 4 ohms and 20 ohms, and, therefore, the combined resistance is between 0·8 ohm and 4 ohms. On each of the vertical lines the distance below the line A C B is proportional to the corresponding *conductance—e.g.*, A—2 is double A—4; B—5 is four times B—20; C—1 is three times C—3. But the scales eventually are not equal—that under A being four times and that under C five times as big as the one under B, in terms of conductance. Correspondingly, B C is made four times the length of A C.

The dotted portion of the figure is required only for constructional purposes, and so need not appear in the finished nomograph; neither is the use of squared paper advantageous except for construction.

To use the nomograph a straight edge is placed across the scales, and adjusted to the values of the two resistances on the outer scales; the middle scale then gives the value of the combined resistance. For instance, the line drawn in fig. 7 shows that 2 ohms and 5 ohms in parallel have a combined resistance of 1·43 ohms. For accurate work the scales would be more finely divided than as shown, but the method has the disadvantage that the scales of resistance are necessarily not uniform, whereas in the previous methods each scale is uniform throughout.

THE PERCENTAGE ERROR.

BY A. T. BULLEN.

MOST electrical undertakings nowadays boast a more or less adequately equipped test-room, but no matter how well equipped that department may be, there is a grave danger of its being most inefficient, unless the results obtained by it are applied in a correct manner.

It is necessary, if the result of a test on any particular meter is to have a definite meaning, that it should be expressed as a percentage error, but unless that percentage error obtained, too, has a definite meaning, it is likely in its application to create still further inaccuracies, and, as we shall see later, this always affects the undertaking adversely: that is, it means a loss to the undertaking which would not occur if the figures were applied in their proper manner.

There are three ways of working and writing the results of a test. The first way is by comparison of the time the meter should take to register a certain amount with the time it actually does take; the second is by a comparison of the constants, and the third is by comparing the watts being registered by the meter with the actual load.

Each method is as correct as any other, and each has some special feature to recommend it, but, curiously enough, if we want to express a percentage error that means the same thing in each case we must approach them in different ways.

It has been discussed and argued frequently among testers as to whether it is correct to calculate the percentage error from the correct time or using the observed time as a

*This method was given without proof by Mr. L. O. Meyer in the ELECTRICAL REVIEW of November 9th, 1917, subsequent to the writing of this portion of the present article.

basis, but it is fairly clear that the observed time is the proper figure to divide by.

Take the case of a meter which should complete 40 revolutions in 60 seconds. For some reason it is now doing its 40 revolutions in 30 seconds. Its percentage error is, obviously, 100 per cent. fast, since it is recording at twice its proper speed. This is—

$$100 \times \left(\frac{60 - 30}{30}\right),$$

$$\text{or } 100 \times \frac{\text{Correct time} - \text{observed time}}{\text{observed time}}.$$

The same applies to a meter tested by a comparison of the constants; the percentage error must be calculated from the observed or calculated constant and not from the true constant; but if the third method of testing be adopted—*i.e.*, a comparison of the watts measured—then the percentage error must be calculated from the correct watts and not from the meter watts, if the same result is expected.

Thus, if 1,000 watts be the correct load under the same conditions as before, the meter will measure 2,000 and the percentage error will be—

$$100 \times \left(\frac{2{,}000 - 1{,}000}{1{,}000}\right)$$

$$= 100 \times \frac{\text{meter watts} - \text{true watts}}{\text{true watts}}.$$

This is all fairly obvious, and the real danger does not come in until we start to apply these figures to the meter under consideration.

Let us take a specific case. A meter having registered 400 units in a quarter, is suspected by the consumer of over-registering, and is accordingly tested. The results prove that the consumer was quite justified in his complaint, and the mean error of the meter is found to be 40 per cent.

An allowance is clearly necessary, and the chances are that 40 per cent. of the account is immediately deducted and an amended account made out for 240 units. But this is wrong. The true meaning of the percentage error has not been grasped.

On test the meter measured 140 watts, where 100 was correct; clearly, then, it is 40 per cent. fast according to our previous argument.

It is; but the error creeps in because the 400 units registered by the meter is comparative to the 140 watts measured when the meter was on test.

The true allowance, therefore, is not 40 per cent. of 400 units, but is $400 - \frac{100}{140} \times 400 = 114$ units, the amended account being for 286 units instead of 240 units.

Thus, unless care is taken, the undertaking will lose 46 units.

Similarly, had the meter been slow, the undertaking would still have lost, for had the meter been again 40 per cent. slow, it would have registered 240 units instead of 400, and the amount added to the account would have been $\frac{40}{100} \times 240 = 96$ units, which would have meant a loss to the undertaking of 64 units.

What, then, is the remedy? It is either a perfect understanding of what is really meant, which is not always easy, because while one person tests the meter another calculates the allowance to be made, or the deficiency, or it is to base the percentage error not on the meter in its ideal state, but on its actual performance; that is, to state that so much per cent. of the units registered are excess units, and *vice versâ*, if the meter be slow.

Applying it to our case, 114 units out of 400 were excess units, that is—

$$114 \times 100/400 = 28{\cdot}5 \text{ per cent.}$$

How, then, can we get that figure in the test room? Simply by basing our calculations on the meter watts instead of the true watts, thus:—

$$\frac{100 \times \text{meter watts} - \text{true watts}}{\text{meter watts}} = 100 \times \left(\frac{140 - 100}{140}\right)$$

$$= 28{\cdot}57 \text{ per cent.}$$

If, on the other hand, we are working on the constant or by the time, we must base our percentage calculation on the correct constant or time.

This is necessary, because if a meter is wrong, it is the wrong figure that is accessible to us; all we know is the actual consumption, and not the true.

These few lines have been written, not because there is any real difficulty in the problem, but because it is one of those obvious things that are so often missed.

In his own experience the writer has proved that such mistakes, if they can be so termed, do occur, but it is hoped that through these notes many, particularly those who are rather inexperienced, but who, through the war or for other causes, have had to assume responsibilities they would otherwise have been spared for a year or two, will benefit, who otherwise would have wandered on in semi-darkness.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from page* 216.)

Messrs. Hadfield's, Ltd., Sheffield.—One of the features of the exhibition is the great increase, not only in the production of ferro-alloys, but of electric steel. The feature of this firm's exhibits is an armour-piercing projectile of 15 in. calibre after perforating a hard-faced armour plate 15 in. in thickness, of which a model is also exhibited, which plate is undrillable for several inches below the surface. "Hadura" hardened steel rolls, for cold-rolling steel and other hard metals, are illustrated by pairs of 8-in. and 16-in. rolls. Before the war such rolls were obtained from abroad, but now all requirements are met with home-made products. A pair of sprocket-wheels as used for tanks and tank plate, which has been subjected to firing trial, illustrate "Era" manganese steel, while "Hecla" steel for aircraft is represented by tensile and impact test-bars, covering a range of tenacity from 50 to 100 tons per sq. in. Helmets and body shields of "Resista" steel, which have been subjected to firing trial, and specimens of the Hadfield-Jack system of producing sound ingots, are on view. Thread milling cutters of "Heclon Superior" high-speed steel, "Galahad" rustless steel, and special magnet steel for replacing the expensive high tungsten steel are also exhibited.

The Watford Electric and Manufacturing Co., Ltd., Watford, Herts.—After manufacturing the "Thury" regulator for some considerable time, this company has now produced a patented type of control pillar embodying in addition to the advantages pertaining to a "Thury" regulator equipment, numerous additional advantages pertaining to the more efficient control of electric furnaces.

The equipment, as will be seen from the illustration (fig. 5 (p. 222), is a self-contained unit for each electrode motor, and the gear is enclosed in a massive cast- and sheet-iron pillar with glazed, hinged, front doors to enable the operation to be under inspection whenever desired. The equipment has been designed to ensure the minimum of knowledge being required to operate the control, and a practically fool-proof equipment seems to have been obtained suited to the rough usage and dirty conditions of a steel works.

To use the control pillar a start push button is pressed by the operator which closes a double pole clapper switch at the bottom of the unit, making the equipment alive and ready for the control of the electrode motors. After such use as is desired of it a stop button is pressed, and the pillar is again made dead with the minimum of control operations. After energising the pillar ready for use by pushing the start button, the melter uses the hand wheel on the left-hand side of this button, which is clearly indicated as being placed in the "auto" position or the direction to raise or lower the electrodes to or from the metal in the furnace. Assuming that he is starting up the furnace, after closing the power switch he brings the electrode down to the metal, and immediately contact is made therewith a superimposed control cuts off the supply from the drum controller operated by the above-mentioned hand wheel, and withdraws the electrode from contact with the metal, on which the operator puts the pointer on the hand wheel to the "auto" position, and the pillar is then in operation for automatic control. It will thus be seen that there is no necessity for hand control of the electrodes as has been the practice thus far. On the right-hand side of the operating push buttons is another hand wheel with a pointer moving over a scale marked "Decrease" and "Increase" respectively, and by means of the operation of this hand wheel the load on the electrode can be varied from full load down to approximately one-sixth of full load.

The above operations constitute the only demand of the melter in controlling his electric furnace, and with this type of control the actual melter responsible for the correct heat being maintained at all times in the furnace is easily able single-handed to maintain all the desired control.

Above the main clapper switch at the bottom of the pillar, and in the lower half of the panel, are situated two other double-pole clapper switches; these are so connected in the armature circuit that when the one closes, a downward move-

ment of the electrodes is obtained, and when the other closes an upward movement is secured; the shunt field of the motor being permanently energised immediately the main clapper switch in the pillar is operated. The rotation of the electrode control hand wheel in the one direction therefore, produces, by energising the downward movement clapper switch, a rotation of the motor moving the electrode to the charge, and *vice versa* for the other direction of rotation of this hand wheel. In the upper part of the pillar there are two regulating devices, one responding to the variations in the current strength of the arc as reproduced in the secondary of a current transformer, and the other responding to the variations of the voltage of the arc. When the controller hand wheel is in the automatic position the energy for operating the motor-reversing clapper switches is supplied through a moving arm in the centre of the pillar which responds to the variations in the current strength-regulating device, and moves between two contacts which give a supply to the alternative clapper switches.

By means of an additional solenoid-operated switch the contact supply through these clapper switches to the motor is made intermittent, so that a step-by-step movement is given to the electrodes during normal current strength-regulating control which permits of the current adjusting itself to the new conditions in the furnace following the movement of the electrodes. The superimposed voltage control provides for the

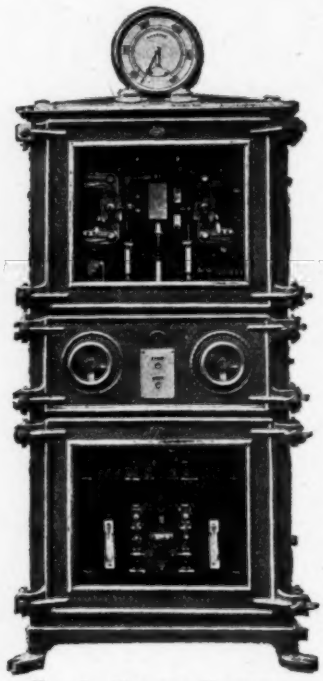

Fig. 5.—Electric Furnace Control Pillar.

normal control of the electrode to be vested in the current strength-regulating device, but immediately there is a fall of pressure across the arc due either to dipping or a heavy overload the voltage control device entirely isolates the current strength-regulation and itself applies current to the solenoid of the raise clapper switch, which withdraws the electrodes from the bath in a rapid and continuous upward movement until the voltage is re-established, when it again automatically reintroduces the current strength-regulating device to the control of the heat in the furnace without the intervention of any external operation.

The making and breaking of the motor armature circuit is provided for by means of the aforementioned clapper switches which are provided with a rolling contact, a magnetic blow-out and interlocking contacts to ensure that the two switches cannot be simultaneously closed. They are further provided with dynamic braking contacts so that when both are returned to the "off" position the armature is dynamically braked through a resistance introduced in the armature circuit, thus pulling up the motor quickly.

The pillar is supplied connected up complete in every way with the exception of the actual leads from the mains and to the motor. In addition provision is made in the pillar to permit of the insertion of upward limit switches to come into operation when the electrode carrier approaches the top of the mast.

An additional special device is embodied in the automatic controlling features to ensure that once contact is made on either side of the regulating contact arm the complete sequence of operations must follow to ensure that this slow-moving contactor device is not called upon to draw an arc by breaking the circuit of the clapper switch solenoid, and thus burn itself away quickly, the actual interruption of this circuit being made on a quick-moving rolling contact over a carbon disk. The pillar can if desired be fitted with an ammeter as shown in the illustration, and a voltmeter can also be attached.

Fleming, Birkby & Goodall, Ltd., Liversedge, Yorkshire.—The manufacture of moulded electrical insulation is quite a specialised art, and one which unfortunately has been somewhat neglected in this country; it is pleasing to note, therefore, that this firm has realised the necessity of giving special attention to this industry. The firm is already well known, but present development is connected more particularly with moulded insulation for general electrical work. Keen and constant research work has been put in on Birkby's moulded insulation during the last four years with very gratifying results. Many difficulties have been successfully overcome and an insulation produced having quite remarkable properties, of which the following are claimed to be some:—

Specific gravity 1.33 to 2.0; dielectric strength of base material 500 volts per mil or 20,000 volts per millimetre; tensile strength 4,000 lb. to 6,500 lb. per sq. in.; unaffected by temperatures from 100 deg. F. to 2,000 deg. F.; has no softening point; unaffected by water, weather, oils, acid-fumes, alkalis, ordinary solvents, live steam, &c.; does not support combustion; not affected by surface condensation; chemically inert; not brittle; extreme accuracy in moulding; made in various colours; contains nothing harmful or anything that will damage metal parts; and it is something entirely different and superior to shellac and similar gum compounds, hard rubber, ebonite, fibre, &c.

It will be readily seen what a wide field of use there is for an insulation of this character. Insulation problems which have caused trouble can now, it is stated, be solved, and a

Fig. 6.—Birkby's Moulded Insulators.

large number of extra requirements fulfilled. One or other of the different grades will be found suitable for practically all electrical requirements.

In addition to moulded insulation the firm also specialises in the manufacture and supply of all other electrical insulating materials, fibre, leatheroid, presspahn, mica, micanite, yellow and black insulating cloth, silk, tape and paper, cotton tapes and webbing, insulating varnish, &c., and is sole maker of Birkby's "Oilless" trolley bush, which has a wide use and reputation. We are asked to state that at present, due to large quantities of Government work, very little, if any, new business can be taken on for moulded insulation, but inquiries from interested firms will be welcomed, and they will be supplied with further information.

(To be continued.)

SOME NOTES ON GAS-FIRING BOILERS.*

By T. M. HUNTER, A.M.Inst.C.E.

Gas is an ideal boiler fuel. The capital cost of an installation of gas burners is small, and gas is simple to use when the principles of its use have been mastered. It is possible to maintain the boiler efficiency at a high level when the fuel supply is regular and uniform; so that gas firing ought to show in every case a higher efficiency than coal-firing. Using softened water and cleaned gas, the boiler should always work in its most efficient state. The economiser can be enclosed in an airtight case, and thus all the cold air leakages are avoided. Gas makes the separately fired superheater a most convenient arrangement. This is an important matter in connection with one modern development of the steam turbine, which calls for reheating the steam after it has passed through one or more of the elements.

The defects of industrial gas, as a fuel, are that its pressure and composition are liable to variations, and that, in the case of most blast-furnace gas in this country, it is heavily laden with dust. Using gas varying in pressure and calorific value, it is difficult to set the combustion arrangements so as always to burn the gas at the highest efficiency. Even on the most

* *Proceedings* South Wales Institute of Engineers. Vol. 34, No. 2. Abstract.

modern installations it is in practice found necessary to burn the gas, in its average state, with 20 per cent. excess of air, not because perfect combustion cannot take place with less air, but simply to avoid the serious loss caused by unburned CO, in the waste gases, when the gas pressure or calorific value increases. Dust in gas fuel is a serious evil; it gets on the boiler tubes and flue walls, and very quickly reduces the efficiency if allowed to accumulate. There are many cases in which it would not pay to clean the dust out of gas. Cleaning involves the loss of the sensible heat in the gas, which amounts often to from 10 per cent. to 15 per cent. of the total calorific value of the gas. The saving in the boiler, by the use of cleaned gas, must be more than this, and must also pay for the power used in the cleaning plant, and for the maintenance and capital charges on that plant. In water-tube boilers, in which the tubes can be cleaned while the boiler is running, it is quite a question whether cleaning will pay, but with Lancashire boilers, which can only be cleaned periodically, cleaning the gas will surely pay. In most boilers at present the burning gases are allowed to impinge directly on the tubes, and thus the dust is burned on to the tubes, and must be removed like scale. So long as this method of combustion is used, gas cleaning is an attractive proposition. In water-tube boilers it is possible to arrange gas burners in such a way that a great amount of the dust can be fused by the flame and left on the floor, and, in this way, only a small amount of the dust in the gas has to be blown off the tubes by the steam lance.

In 1915 one of the officials of the United States Steel Trust stated that they had made tests, and found that, over all their plants, the average boiler efficiency of their water-tube boilers, fired with uncleaned blast-furnace gas, was 55 per cent. Their experiments made with various forms of burners showed them that they could easily improve this average to 65 per cent., but that it was doubtful whether they could maintain 70 per cent. efficiency for very long at any of their plants, under ordinary working conditions. These figures are for boilers alone, and do not include efficiency of superheaters, economisers, or air pre-heaters.

Water vapour in the gas, in any quantity, has a very serious effect on the efficiency of combustion. It lowers the flame temperature and increases the amount of heat carried away to the chimney by the waste gases. Such moisture should, wherever possible, be eliminated by cooling the gas to 30 deg. C. or lower. The discovery of potash in blast-furnace gas, as a by-product in the manufacture of iron, has brought the subject of gas cleaning into very great prominence. The dry processes of cleaning give the dust in a condition ready for immediate sale, so that they have great attractions from the point of view of the recovery of potash. The wet cleaning process has the additional disadvantage, from the gas-firing point of view, that all the sensible heat in the gas is lost, and that the gas is generally loaded with a fine spray of moisture, which must be evaporated and raised to the flame temperature.

In the Halberg Beth process the temperature of the gas as it leaves the cleaning plant is about 70 deg. C. In very many cases the moisture supplied in the ore and the coke is sufficient to saturate the gas at this temperature. Any moisture over this amount, which has found its way into the furnace, is condensed as the gas is being cooled before the cleaning plant. The gas at 70 deg. C. carries only some 2 B.TH.U. per cubic foot of sensible heat, which is almost a negligible amount. If this gas is burned and the products of combustion pass to the chimney at 250 deg. C., the moisture present in the gas is responsible for a loss in efficiency of 5½ per cent. compared with the result to be attained by burning the same gas supplied at atmospheric temperature and saturation. This loss in efficiency rises very rapidly as the temperature of the gas rises, if it is still saturated. At 100 deg. C. the gas carries 3 B.TH.U. of sensible heat per cubic foot, whereas the moisture carried at just under that temperature is three times as much as at 70 deg. C. It is evident from these figures that it will not pay to retain these small amounts of sensible heat, when the gas is loaded with moisture, but that further cooling of the gas must be done.

Take now the case of gas cleaned at a high temperature by the Lodge electric method. We find in the gas all the moisture put into the furnace, and at times this may be a very large amount. On the other hand, the sensible heat carried by the gas is much larger. At 200 deg. C. it is 7 B.TH.U. per cubic foot, at 250 deg. C. it is 9 B.TH.U., at 300 deg C. it is 11 B.TH.U. Further, the temperature of the waste gases leaving the boiler is little if any greater than the entering temperature of the gas. The loss due to moisture in the gas, in this case, is that due to the poorer transfer of heat caused by the lower flame temperature, which is the result of the dilution of the products of combustion by the water vapour. This loss is one of boiler output, not of efficiency, so long as the amount of water vapour present is not sufficient to prevent complete combustion of the gas. Provided we have ample boiler-heating surface, the loss may be neglected. Cleaned gas should never be sent to the chimney at a higher temperature than 250 deg. C.; economisers of one kind or another should always be fitted to reduce the temperature below this figure. If there is a large quantity of moisture in the cleaned gas, it may be necessary to sacrifice the sensible heat of the gas and to throw away even as much as 10 per cent. of the calorific value in this way, for the sake of getting combustion at a reasonable temperature and to get an adequate boiler output.

The losses due to the admission to the boiler of any air in excess of the minimum amount required for the combustion of the gas, are the most serious losses in the firing of boilers with gas. Whether the air is admitted through the burners or finds its way in through the boiler setting, is of little consequence. The author need not labour this point, but it should be noticed that, in practice, the theoretical flame temperatures are never reached: that the ignition temperature of the gases with which we are dealing is about 600 deg. C.: and consequently, if we use a large excess of air for combustion, we soon approach near enough to this temperature with our flame temperature to make complete combustion in the vicinity of the boiler tubes almost an impossibility. For these reasons we are led to conclude that the scientific method to follow in burning gas is to use an arrangement or burner which gives us complete control over the conditions of combustion, for then only shall we be able to reproduce the conditions of maximum efficiency.

The huge losses involved in boiler firing by gas are not realised. The ordinary efficiency of gas-fired boilers, under present conditions, is from 50 per cent. to 60 per cent., and many boilers fired with blast-furnace gas work at an efficiency as low as 30 per cent. Figures have been obtained by careful testing, using gas meter or gasometer, which show the following results: 83 per cent. efficiency for a water-tube boiler with superheater, but without economiser, fired with coke oven gas; 80 per cent. for a Lancashire type boiler, with both superheater and economiser, fired with cleaned blast furnace gas; 79 per cent. for Lancashire boiler, with both superheater and economiser, fired by producer gas; 65 per cent. to 67 per cent. for many tests on water-tube boilers, without superheaters or economisers, fired with uncleaned blast-furnace gas. The difference between these figures, in the case of one boiler, is sufficiently startling. In the case of a small ironworks, where 100,000 lb. of steam are raised per hour by gas, the cost of the steam, if it were raised by coal, would be about £40,000 per annum. A saving of 25 per cent. in efficiency means a saving of £10,000 per annum.

The essentials for the economical combustion of gas are that the gas should burn immediately and completely, at the highest flame temperature and with the smallest excess of air. America and the Continental countries are far ahead of us in gas-firing matters. They have long ago proved that the best combustion takes place when gas and air are intimately mixed before combustion begins. For this reason, one or other variation of the Bunsen burner is almost universally fitted in modern foreign works. There is not one such installation in this country so far, and indeed, the pre-heating of air for the combustion of gas has hardly been considered here. The usual method of burning gas in this country is to admit the air and gas by ports in the boiler front, with or without external combustion chambers, and to let them mix while combustion is taking place. Under these circumstances the flame temperature never rises to anywhere near the possible figure, the flame is long, combustion is slow, and in many cases is still going on in the chimney. This has been recognised in certain Babcock boilers, fired with uncleaned blast-furnace gas. These are made with tubes spaced farther apart than usual, and improved results are obtained simply by the additional space left for combustion. It is evident that the results must be far better when the gases are completely burned in the combustion space below the tubes. Using modern burners with gas or air under pressure, far more gas can be burned in the boiler than is possible by the older method, while at the same time the efficiency is raised. If high boiler outputs are required, a high pressure of air or gas will give a short intense flame, and the boiler output will only be limited by the volume of waste gases with which the boiler flues can deal.

To attain an intimate mixture either the gas or the air must be under a pressure, which should not be less than 2 in. w.g., or induced draught may be used. It is preferable, unless the boiler brickwork is enclosed in sheet steel, to use gas or air under pressure, or both, at the burners. By doing this, the serious leakage of air into the boiler through the brickwork, often through invisible cracks, is avoided, as the whole of the boiler can be kept under a very slight pressure and the products of combustion simply drawn away from the damper by the chimney draught. The cost of the power required to supply this pressure is very small. About 1 per cent. of the power generated is all that is needed. The flames formed by the combustion of the industrial gases when burned with a correct amount of air, can generally be described as blue and colourless. They would take a place towards the blue end of the spectrum; and, consequently, they do not give out much heat by radiation, as is done by flames which give a line near the red end of the spectrum. The problem of taking the heat out of gas flames is very like that of best utilising the waste heat from coke ovens or steel furnaces.

The author made a number of experiments upon a Lancashire boiler, fired with cleaned gas, in order to discover whether a brickwork arrangement in the flues could be designed, which, while not seriously diminishing the chimney draught, would cause much of this heat to be transferred as radiant heat. Many arrangements were tried, but the conclusion come to was that is was not possible, with natural draught, to heat the brickwork to such a degree that the transmission of heat was measurably improved. The result was practically the same in the case of brick baffles built in the flues. Such baffles are very useful where it is necessary

to mix air and gas during combustion, but this seems to be their sole function, when working on chimney draught alone, and this action is not required when firing the boiler with suitable burners.

The subject of the transfer of heat from hot gases to the water in the boiler is of great interest to anyone who tries to design a boiler specially for gas-firing. Most of the heat must be transferred from the gas by actual contact between the gas and the tubes. It is found that by far the greatest part of the resistance to this transfer of heat occurs at the surface where the gases touch the tubes; the resistance to transfer through the metal, and from metal to water, is almost negligible in comparison. The reason seems to be that a very thin film of cooled gas sticks to the boiler tubes and prevents the contact of hot gases with the tubes. There are two ways of getting over this. Either the surface of the tubes in contact with the gases may be greatly increased in relation to the wetted surface of the tubes, as is done by the use of corrugated flues or ribbed tubes, or by using small-tube water-tube boilers like the Yarrow boiler; or the gases may be caused mechanically to scour the surface of the tubes, sweeping away this layer of cooled gas, and making close contact all the time between the hot gases and the tubes. This can be done by applying considerable power to the gases in the way of forced draught or suction, as in the Bonecourt boiler, where, in addition to the gas pressure available, suctions of as much as 16 in. w.g. are employed, and the transfer of heat through the fire tubes is enormously increased. It is claimed that evaporations of 30 lb. per square foot of heating surface per hour can be got continuously, and that the whole of the combustion takes place in the first 2 ft. of a 15-ft. boiler tube. The transfer of heat through this part of the fire must therefore be enormous. The author would not like to be near one of these boilers should any trace of oil get into the feed water.

Similar results, with a much more reasonable temperature gradient through the length of the fire tubes, could be attained by the use of suitably designed boilers, with much smaller suctions than 16 in. w.g. The Lancashire boilers made thirty years ago, with a tube plate about 20 ft. from the front and small fire tubes running from it to the back of the boiler, would make excellent boilers for gas-firing, provided we were prepared to use induced draught, and to treat them as internally fired only, giving up the outside heating surface. Only the smallest suctions can be applied to boilers with brick settings, owing to air leaking in through the walls. If, however, we caused the gas to burn completely in the wide flues, and then drew the products rapidly through the small fire tubes, we should get an adequate duty from the boiler, at a high efficiency; and we should cut out all the loss by air leakage and much of the loss by radiation, which are so serious in the Lancashire boiler as usually fired. The marine type of Scottish boiler, with two or more flues, would be even more suitable for this treatment, and the author expects soon to see boilers of this type used for gas-firing. He believes that this boiler would beat the best water-tube boiler in efficiency.

The cost of the power used to produce the forced or induced draught, must be debited against the boiler before the net efficiency of the boiler is brought out. To give a suction of 16 in. w.g. on the boiler, at plants where 30 lb. of steam are required per H.P.-hr. in the engine driving the fan, costs 10 per cent. of the steam raised in the boiler: it costs 4 per cent. of the steam where 12 lb. of steam per H.P.-hr. are required, as at modern power stations. A 4-in. w.g. pressure or suction should be enough for the boilers just described, and this would only cost a fraction of these amounts, while the added efficiency of the boilers would far more than pay for the steam used. It must, however, be considered in each case whether it would not be cheaper to install additional boilers, and to run them at natural draught, than to run the boilers with mechanical draught, at higher outputs. The improvement in efficiency attainable by the latter method is the factor which will decide the question.

The provision of pre-heated air for combustion is even more important when using gas than when using coal fuel. At many works no economisers are fitted on the boilers because the feed water is already heated by the exhaust steam from the engines. It is quite usual to find a temperature of 350 deg. C., and often more, in the waste gases from gas-fired boilers, if they are working at a fair output. This could easily be reduced to about 200 deg. C. by the use of a good air heater. The gain to the boiler is not merely the number of B.TH.U. added in the hot air, though that would amount to a considerable addition to the calorific value of the gas. Pre-heated air promotes much better combustion and a higher flame temperature, and thus improves the heat exchange. It is of no use to pre-heat the air or gas by extracting heat from the flame, or from the waste gases before they leave the boiler. This merely returns with one hand what is taken away with the other; yet we see patents seriously taken out which claim to make great savings by these means. Modern air pre-heaters can be used even with uncleaned blast-furnace gas, as the plates can be brushed or blown clean at frequent intervals while the heaters are at work, with a very small amount of labour.

The author has twice come across cases where it was stated that gas-firing was responsible for damage to the boiler tubes. He has had experience of boilers, fired for many years with Mond gas, which show absolutely no damage at all. If gas is burned with a small excess of air, so that there is a minimum of oxygen in the burned gases, and if combustion takes place quickly, so that it is practically complete before these gases touch the boiler tubes, no damage whatever can happen to the tubes. In firing water-tube boilers he always likes to arrange the gas burner, pointing towards the floor, at an angle of, say, 20 deg. below the horizontal, so that the gases may be completely burned before rising to the tubes. This has the further advantage that the brickwork of the boiler, upon which the flames play, is kept very hot, and assists in the rapid combustion of the gas. In the case of uncleaned blast-furnace gas, the flame temperature is so high, by this method, when burning the gas with a small excess of air, that much of the dust can be melted, and thus thrown out of the products of combustion, instead of being burned on to the tubes.

He has records of a large number of readings made in America of the flame temperatures in water-tube boilers fired in this way. The temperature was measured in the combustion space, about two feet in front of the burner nozzles. The temperatures range from 1,040 deg. C. to 1,260 deg. C., the average being fully 1,160 deg. C. The CO_2 reading in the gas averaged 23 per cent. He does not know what the possible flame temperature would be with the gas used and this small excess of air, but judging from the calorific value, which was about 102 B.TH.U. per cubic foot, he would say that it was about 1,300 deg. C. Similar tests were made on other boilers into which the gas and air were admitted by ports in the front of a combustion chamber. This chamber was large enough for complete combustion of the gas, so that here also the CO_2 readings averaged about 23 per cent. The temperatures in the combustion chamber varied from 760 deg. C. to 960 deg. C., with average about 900 deg. C., while the possible temperature to be attained was the same as before, viz., 1,300 deg. C.

These tests show clearly the great advantage of gas-firing in a scientific way. The old combustion chambers, at small boiler loads, were able to give about the same results as regards composition of the chimney gases. By using gas burners, no combustion chambers, with their high radiation losses, were required, and a better transfer of heat could be made, resulting in a higher boiler load and better efficiency.

While in the case of large boilers we may adjust the variations of pressure, air supply, and chimney draught automatically, we must recognise that at most plants this is not likely to be done, and we shall have to rely on the control of the boilers by more or less skilled men. Boilers fitted with the best combustion arrangements will give results 5 per cent. better, if intelligently controlled, than they will give if run by the usual boiler men uncontrolled. If the boiler men could earn a small premium for maintaining good results, they would quickly see that it was to their interest to study the results they were getting, and would reduce economy in boiler firing to a fine art.

WAR ITEMS.

Letters from Soldiers.—A corporal with the Forces at home, in acknowledging receipt of the ELECTRICAL REVIEW, says: "It is most highly appreciated, and keeps one in connection with the old world, which sometimes seems to be a shadow of the past, but which is constantly being illuminated by the REVIEW."

A reader who has been in France a long time writes:—"Please accept my apologies for not having written you ere this to thank you for your continued kindness in forwarding the REVIEW to me so regularly. . . . I appreciate it very much indeed, and you would be amused at the crowd of men who hover around my tent on Tuesday evenings (REVIEW usually arrives Mondays) inquiring 'if I have finished with it yet.' We find much pleasure, and I hope profit, in discussing the various articles, and it is exceedingly gratifying to know that even if we are far away from our old lives, and, in many cases, occupations, we are still able to keep posted as to all the happenings at home. I am afraid some of the works at home must be carrying on under great difficulties. Shortage of staff, heavy cost of coal and oil, daylight saving, rationing of consumption, and early closing of shops all help to do them a little bit of 'no good.' Still, it is something to be able to carry on at all, I suppose, and I certainly think that the men at home are to be congratulated on the good work they are doing. I know, from personal experience, that it is very hard to keep on with one's daily duties; everyone seems to look at you with contempt, and give you that 'why are *you* not in khaki?' stare. Many of those at home are having a harder time of it, mentally, at all events, than those out here, and although I long to get back again, I do not envy them."

To be Wound Up.—Winter & Almenraeder, 48, and 49, Great Sutton Street, E.C.1, importers of vulcanite, &c., successors of H. Traun & Sons, 25, Goswell Road, E.C.1, manufacturers of ebonite. Controller, Mr. J. D. Pattuth, 65, London Wall, E.C.2.

Labour Supply.—To co-ordinate the functions of the several Government departments concerned in the regulation

and supply of labour, the Ministry of National Service, the Ministry of Labour, and the Ministry of Munitions have agreed to adopt a uniform grouping of counties into nine administrative districts.

Westinghouse War Relief Fund.—We have received a copy of the statement of receipts and payments of the British Westinghouse Employés' War Relief Fund from August 22nd, 1914, to June 30th, 1918. Of the total amount contributed (£57,253), £38,061 came from the employés and £19,191 from the company. There has been paid out to dependents £38,147. £12,393 is set aside for a disablement and dependents' fund, and £2,479 has been spent in donations to local and national funds and in Christmas gifts. The number of families in receipt of weekly relief is now 822, and the number of employés who have joined His Majesty's Forces is 3,461, among whom, unfortunately, the casualties have been exceedingly high.

Reconstruction.—From time to time we have summarised generally the important investigation operations of the Ministry of Reconstruction. We have never underestimated the value of the work of this department, for we recognise that it is only by an expert understanding of the various problems bearing upon the national life that we shall be enabled to prepare for the new state of affairs that will exist when war activities, military, naval, and industrial, come to an end. Occasionally we have been privileged to put before our readers certain special aspects of reconstruction relating to industry and trade, demobilisation, raw materials, and so forth. There will be many readers, however, who will be anxious to have before them a connected general summary of the problems and proposals of the Reconstruction Ministry, and this is now made available for them by the Ministry itself in the form of a 20-page pamphlet (No. 1 of a series), entitled "The Aims of Reconstruction." The questions briefly reviewed are: Shipping, raw materials, allocation of raw materials, transport, demobilisation, industrial organisation, joint industrial councils, interim reconstruction committees, working conditions, social development, health, housing, education, and problems of finance. Copies of this pamphlet, and of the second of the series which deals exclusively with "Housing in England and Wales," can be obtained at twopence each from the Ministry of Reconstruction Offices, 2, Queen Anne's Gate Buildings, Westminster, S.W. 1.

Exports to China.—The "London Gazette" for September 3rd contains a supplementary list of persons and bodies in China to whom exports may be consigned.

Exemption Applications.—At the Yarmouth Tribunal, the case of an electrician (38), in Grade 2, was reviewed on the ground that he was of the old military age, and it was not in the national interest that he should remain in civil life. His father said he was the only man left of five, and was engaged on the X-ray apparatus at the hospital. Originally he was placed in Grade 3, then put into Grade 1, and on appeal placed in Grade 2. It was impossible to obtain skilled men now. Lieut. Hadley pressed for the man subject to a substitute being found. Temporary exemption for two months with a view to substitution.

An electrical engineer and contractor (32, Grade 1), who appealed at Oldham, was given until the end of September with a view to securing a trade protection card.

At Salisbury, the National Service representative appealed for withdrawal of conditional exemption held by an electrical installation attendant (44, Grade 1) at Alderbury. The employer said that the man was responsible for the supply of electricity to an estate and for private purposes, and it was not possible to substitute him. Exemption until January 1st was granted.

At Windermere, J. K. Thornborough (37, Grade 2), electrical engineer, who appealed, was granted a month in which to obtain a certificate of full-time national service.

Before the Somerset Appeal Court, the National Service representative appealed for the withdrawal of conditional exemption held by W. R. Hewlett (37, Grade 2), electric light fitter, of Taunton. Respondent stated that he worked at least 75 hours per week, his business was one of the oldest in the town, and his occupation was a certified one. The appeal was disallowed.

Hambledon (Surrey) Tribunal has granted three months' exemption to A. Ashdown (48), electrician, of Wormley.

At Weston-super-Mare, exemption was asked for H. Brewer (40, Grade 2), wireman with the Electrical Supply Co., Ltd. It was stated that he was one of the two wiremen left, whereas before the war there were from eight to twelve. It was urged that the man was needed as he was experienced. Six months were granted, with leave to apply again.

At Dover, the Corporation appealed for further exemption for W. J. Revell (28, B2) and W. C. Peddrick (41, B1), drivers of electric scavenging vehicles. It was suggested that women could act as drivers, but it was stated that a woman should not be asked to drive up the steep track used. Each was given three months, and six months were conceded to F. Quinnell (46, Grade 3), engine driver at the electricity works; and three months to A. Robertson, electrical engineer to the tramways.

At Reigate, the East Surrey Traction Co. appealed for W. P. McAlpine (38, Grade 2), electrician and magneto repairer, and with the consent of the National Service representative, he was granted six months' temporary exemption.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

The report of the Committee of the Privy Council for Scientific and Industrial Research for the year ending July 31st, 1918, has just been issued (Cd. 9,144; 4d. net). It states that the past year has seen a great extension of the work of the Department. The National Fuel Research Station at East Greenwich will, it is hoped, begin work this year; the buildings and equipment are estimated to cost about £120,000. The National Physical Laboratory has been taken over, and the very inadequate salaries of the staff have been increased. A Research Board has been established, with Sir Lionel Phillips as chairman, to develop researches into the production of tin and tungsten in Cornwall, and other important investigations have been undertaken.

Satisfactory progress has been made during the year with the negotiations between the Department and the industries of the country for the establishment of industrial research associations, for which purpose Parliament voted a sum of 1 million sterling; model articles have been drawn up, and, with an amended memorandum, are appended to the report. An industry can establish an approved association without seeking assistance from Parliamentary funds, and such association will have exactly the same privileges, and receive the same assistance in the way of advice and information as associations in receipt of grants. The Department has found sometimes a certain hesitation on the part of manufacturers to establish relationship with the Government for the purpose of research, fearing that the Department will interfere with the work, and prevent the results of research from reaching the firms which have subscribed to its cost, or give the results to competing firms which have not joined, or have left the association. The intention of the Department is that the associations shall manage their own affairs and benefit by their own discoveries. If the firms in an industry will undertake research on any plan which they think suited to their needs, they will receive the sympathetic consideration and assistance of the Department.

The Department has guaranteed to the British Scientific Instrument Research Association an expenditure of £36,000 on approved research during the next five years.

The amount standing to the credit of the Research Fund on July 31st was £1,016,391; a sum of £11,181 had been transferred to the current account for the payment of impending grants. Various funds in connection with the National Physical Laboratory have been taken over by the Imperial Trust. During the year three patents have been taken out by the Trust in conjunction with the inventors. Fifteen recommendations in respect of individual researches have been approved, and five other researches have been continued, under the control of the department. Recommendations have been considered in respect of, and to, 21 scientific investigations of industrial importance conducted by other bodies, of which 15 had received aid in 1916-17. Grants were made to 25 students under training in methods of research, and to 36 workers engaged in research. The expenditure under this head was £7,500, comparing with £3,550. The number of students and workers during the session 1918-19 is likely to be further increased. The expenditure during the year was £30,825 out of the sum of £38,050 taken in the estimates—more than twice the expenditure in the previous year. The value of the work done was beyond all comparison greater than its cost. For the current year a sum of £163,350 has been taken, including a sum of £89,750 for the services of the National Physical Laboratory, which will also receive from the various War Departments payments amounting to £74,100.

The Report of the Advisory Council states that throughout the year attention has been given to the organisation of those fields of research which cannot be covered by means of research associations—researches of a national character. Attention is drawn to the danger that after the war there will not be an adequate supply of trained research workers, and the Department throws the responsibility for recruiting the army of men and women that is needed upon the education authorities of the country. In this connection the findings of the Committee appointed to inquire into the Position of Natural Science in the Educational System of Great Britain are cited, and the Advisory Council emphasises the necessity of prompt action.

Referring to the progress made in the establishment of research associations and the organisation of national research, the report deals with questions relating to the Standing Industrial Councils of the Whitley Report, the conditions prevailing in different trades, &c. The foundation of the British Scientific Instrument Research Association on May 16th last is regarded as a very important event; this Association "has every prospect of becoming the representative industrial body dealing with the application of science to the manufacture of instruments of precision." It was not found possible to bring the makers of internal-combustion engines into one association, owing to the absence of sufficient common ground for common action; the makers and users of refractories similarly did not see eye to eye, and the Council has decided to act independently by promoting research at the Pottery School at Stoke, and assisting the Institution of Gas Engineers to carry on research. The proceedings of the National Physical Laboratory, the Fuel Research Board, and other important organisations are outlined, and particulars are given as to the progress made on similar lines in the Dominions and the United States.

Touching the regulations under which the Council makes grants in aid of researches to students and other workers, and which specify that the Committee of Council must be the first recipient of the results of investigations, and will decide "in the national interest" to what extent the results shall be made available, also reserving to the Council the right to determine whether, and to what extent, the bodies and persons who have taken part in a

research shall secure patent rights, &c., and the profits arising therefrom, the Committee says that in practice no worker has found these conditions unfair. The action of the Department is limited to cases in which the national interest is affected, and where results of commercial value are concerned. It is not in the national interest that results of commercial value obtained by the expenditure of national funds should be made available for other countries, to the detriment of our own; nor that such results should go to a single firm to the detriment of other firms in the same industry who are equally willing and able to take up a new idea; nor that successful research workers should be unfairly exploited by manufacturers or company promoters, and where the means for research has been found by the Government, the Department intends to secure a generous reward to the inventor.

As a rule, the results of investigations are made available for publication at once.

The following is a summary of the grants made and considered during the year 1917-18:—

Grants made to students, pure science	21
" " " applied science... ...	5
" " research assistants, pure science	5
" " " " applied science	5
" " research workers, pure science ...	8
" " " " applied science	14
" " for apparatus	9
Grants refused—students	1
" " research workers...	8
Applications referred to other departments ...	6
" withdrawn—students	9
" " workers and assistants	11
	102

Again emphasising the deficiency of scientific students, the Committee quotes the report of Sir J. J. Thomson's Committee, and states that it is prepared to recommend allowances for students under training or salaries for additional research assistants, but cannot supplement the salaries of the permanent staffs of the Universities.

Applications for assistance have been received from 11 inventors, but in no case has a grant been made.

BUSINESS NOTES.

Australian Government Contracts.—The Australian Commonwealth Government recently decided to constitute a Stores Supply and Tender Board for the Commonwealth, and the following appointments have been made:—Mr. J. R. Collins, Secretary to the Treasury (chairman); Messrs. M. L. Shepherd (Secretary to the Prime Minister's Department), G. L. Macandle (Naval Secretary), W. D. Bingle (Secretary to the Works and Railways Department), Atlee Hunt (Secretary to the Home and Territories Department), and J. Oxenham (Secretary to the Postmaster-General's Department). The acting secretary is Mr. O. D. Daly, and the Board's functions are to arrange the supplies of all goods for the several Commonwealth Departments.—*Tenders.*

Book Notices.—*Handbook of National Kitchens and Restaurants.* Pp. 64, figs. 37. London: Ministry of Food.—In view of the coal shortage and the difficulties that will be experienced during the winter months, both the Coal Controller and the Food Controller feel that the wide extension of national kitchens throughout the country would be of material assistance in meeting any situation that may arise. The Ministry of Food will lend the necessary capital, free of interest, the same to be repaid in 10 equal annual instalments, to any local authority that desires to set up national kitchens or restaurants. The booklet under notice is the official handbook of national kitchens issued through the N.K. Department of the Ministry of Food. It deals in a comprehensive manner with the setting up of kitchens and restaurants by local authorities, giving expert advice on all matters appertaining to this national movement. A foreword is contributed by the late Lord Rhondda and an introduction by Alderman Chas. F. Spencer, Director of National Kitchens. The first half of the handbook deals in a clear and concise manner with such subjects as the size of kitchen, adaptation of existing buildings, choice of equipment, staff, finance, &c. Rural kitchens and village canteens are also dealt with, while six appendices are added in which lists of equipment and goods required, together with a number of varied and useful recipes, are given. The handbook should be found most useful and helpful to all who are interested in the movement; copies free of charge may be obtained from the Ministry of Food, N.K. Division, 4, St. Paul's Churchyard, E.C. 4.

"Reconstruction Problems." Parts I and II. London: Ministry of Reconstruction. Price 2d. each.

"Power Plant." By T. R. Wollaston. 1918. Manchester: Sherratt & Hughes. Pp. 116, 17 figs. Price 5s. net.

"Alternating-Current Electrical Engineering." By Philip Kemp. Pp. viii + 494; figs. 399. London: Macmillan & Co., Ltd. Price 17s. net.

"Volumetric Tests in Scientific Glassware." National Physical Laboratory, Teddington.—This is a pamphlet prepared by the Metrology Department, describing the conditions which must be complied with when scientific glassware is sent for test, the nature of the tests, fees, &c.

Advertising and Trade.—Messrs. Greenly's, Ltd., advertising specialists, of 37 and 38, Strand, W.C. 2, are issuing a monthly circular, entitled "Business" (Methods, Plans, Opportunities). The August issue discusses advertising as a means for the exploitation of markets.

Liquidation.—British Telegraph Instrument Co., Ltd.—Creditors must send particulars to the liquidator, Mr. J. H. Webb, 179, Clapham Road, S.W. 9, by October 7th.

Bankruptcy Proceedings.—A. M. Ferguson, electrician, 424, Chester New Road, Warrington.—Receiving order made August 26th, on debtor's own petition.

Fire.—Messrs. W. Canning & Co., electro-platers' engineers and manufacturing chemists, whose Snow Hill Engineering Works, Birmingham, were totally destroyed by fire on August 23rd, having found it impossible to rebuild the engineering works without delay, have purchased extensive premises and machinery, as a going concern, at Salop Street, Highgate, Birmingham, formerly in the occupation of Piston Rings, Ltd. (Telephone Nos. 638 and 2424 Midland), and work has already been resumed. The damage was said to amount to more than £20,000.

Organisation of Electric Furnace Makers in America.—A meeting was held recently in New York of certain electric furnace manufacturers of the United States, at the request of the General War Service Committee of the electrical manufacturing industry, the result of which was the formation of a permanent Committee, to be known as the Electric Furnace Industries War Service Committee, for the duration of the war, or for such a length of time as it is apparent that there is a necessity for it, by the Government, to compile and detail information pertaining to the electric furnace industries in connection with steel, non-ferrous alloys and metals in general where the melting problem is concerned.

"Anchor" Works Hospital and Distress Fund.—The annual report of this Fund connected with the Leigh Works of Callender's Cable and Construction Co., Ltd., was submitted to the recent annual meeting. The scheme, which is systematically subscribed to by all the "Anchor" employés of 17 years of age and upwards, embraces "The Hospital and Distress Fund" and "The Special War Fund." To the former the employés have contributed during the year £227 16s., and have made substantial grants to local and Manchester hospitals, and the balance has been paid to necessitous members, whose cases are carefully investigated by the Committee. The contributions to the "Special War Fund" amount to £1,000 all but a few shillings; £232 has been dispensed amongst hospitals and war charities, and £373 expended on comforts in the shape of parcels and postal orders for the numerous "Anchor" employés serving with H.M. Forces. At the annual meeting (presided over by Mr. A. Crooke, in the unavoidable absence of Mr. J. Bowyer, "Anchor" Works manager), contributions were voted to hospital and war charities for the coming year. The administrative work is undertaken by a Committee with Mr. W. Mort as hon. treasurer, and Mr. R. Hocken, hon. secretary.

LIGHTING AND POWER NOTES.

Aberdeen.—Extensions.—The T.C. Electricity Committee has agreed to purchase new converting plant, at a cost of £6,755.

Argentina.—The electric lighting and tramway undertakings of the City of Asuncion have been acquired by the "Cia. Americana de Luz y Traccion," which intends to develop the electricity works and to electrify the steam section of the tramways. The company is controlled by the same group of Italian, Swiss, and Argentine capitalists who own the "Cia. Italo-Argentina de Electricidad"; the president is Ingeniero Juan Cardsio.

Senor Enrique Moranz has been granted a concession by the Senate of the Province of Cordoba to install electricity at Capilla del Monte for 20 years.—*Review of the River Plate.*

Australia.—Sydney.—Owing to the scarcity of electric motors, the Council has suspended its arrangements for the sale of hired motors.

Barnstaple.—Price Increase.—The charges for electricity supplied by the T.C. for lighting and power purposes are to be increased by 20 per cent. from October 1st next.

The T.C. has increased the maintenance premium payable to the D.P. Battery Co. by £25 per annum.

Calder Valley.—Wages.—All classes of municipal employés in the district between Todmorden and Brighouse are demanding an increase of wages of 30s. per week above pre-war rates. In view of an award by the Committee on Production, about a month ago, of a 2s. advance on the existing 16s. above pre-war rates, the Calder Valley Wages Board has declined to accede to the demand, and the men have decided to tender their notices.

Continental.—Sweden.—According to the *Board of Trade Journal*, an electric power company, with a minimum capital of 1,000,000 kroner, has been formed at Stockholm.

Darwen.—Price Increase.—The Electricity Committee has recommended that the charge for electricity be increased to 8d. per unit.

Wages.—The employés at the electricity works have applied for an increase of 3s. 6d. per week, in accordance with the last award of the Committee on Production.

Dublin.—E.L. Restrictions.—The Electricity Committee has now enforced the new regulation reducing the supply for lighting to two-thirds of that consumed in the quarter from September, 1917, with a proviso that if the amount is exceeded the supply will be cut off altogether.

Elland.—Price Increase.—The U.D.C. has increased the charges for energy, from the September meter readings, as follows:—Lighting, 6½d. per unit; heating, 2d., plus 60 per cent.; power, 2d., subject to existing sliding scale for consumption per H.P. of maximum demand, plus 60 per cent. on net invoice.

Epsom.—Price Increase.—The U.D.C. has advanced the charges for electricity as follows:—For lighting, flat rate, 8d. per unit; sliding scale, up to 1,800 units per annum, £45; 1,800 to 3,000, 6d. per unit; 3,000 to 6,000, 5½d.; 6,000 to 9,000, 4½d.; beyond 9,000, a flat rate of 5½d. Houses not exceeding £25 rateable value will be charged £1 19s. per annum for two 25-C.P. lamps, £2 11s. for three, £3 for four, £3s. 6s. for five, and 6s. for each lamp over five. Power and lighting, flat rate, 4d. per unit; sliding scale, up to 400 per quarter, 4d.; 400 to 1,000, 2½d.; 1,000 to 1,500, 1½d.; 1,500 to 2,100, 1d.; beyond, 2,100, a flat rate of 2½d. Power for flat irons, 15s. per annum each iron.

Greenock.—Year's Working.—The past year's income of the Corporation electricity department amounted to £117,588, and the expenditure to £110,000, compared with £96,843 and £86,000 respectively in the preceding year. The output increased by 3,810,282 units. The reserve fund now stands at £46,497.

Leeds.—Wages.—An application from the employés of the electricity department for payment of double time for Sunday work has been refused by the General Purposes Committee.

Liverpool.—Price Increase.—From the end of the present quarter the Corporation is increasing the price of electricity for lighting and power by a further 10 per cent., making 40 per cent. over pre-war charges.

London.—Proposed Price Increase.—The Charing Cross, West End, and City E.S. Co. has applied to the B. of T. for permission to increase the maximum price of electricity from 5d. to 6d. per unit.

Malaya.—Electricity in Tin Mining.—In 1917 in the Federated Malay States 55,576 H.P. was used in the tin mining industry, of which 2,420 H.P. was steam-electric and 4,395 hydro-electric. The Tin Bentong Co.'s hydro-electric power plant and an electrically-operated dredge were the only new plant of any magnitude installed during the year.

Nottingham.—Proposed Extensions.—With regard to the scheme of the E.L. Committee for the installation of new plant at the Trent Side power station, the Chairman of the Committee states that Government permission to proceed with the scheme cannot be obtained until after the war.

Ormskirk.—Price Increase.—The Ormskirk Electric Supply Co. has increased the charges for electricity for all purposes by a further 10 per cent., from August 31st last.

Oxford.—Explosion.—Three persons were injured by explosions, one of which occurred in the street and the other in a cellar, in the Carfax district last week. The city engineer informed a local newspaper that the electric light cables fused at a point where two gas mains crossed over them, with the result that the gas-pipes were burnt through, and the gas immediately took fire. At the time the three covers of the chambers of the electric cables were off, and there was no smell of gas perceptible at them. Gas, however, found its way into a chamber on the line of the telegraph cable, and by some means was ignited and exploded. With regard to the explosion in the cellar, it was evident that some of the gas had accumulated there, and appearances pointed to the probability of someone having taken a naked light into the cellar. In relaying the electric cable it is being placed in a wooden trough filled with bitumen, so as to keep it from contact with pipes, and it is hoped that this will prevent any such occurrence in future.

Salford.—Wages.—In accordance with the award of the Committee on Production, the Electricity Committee has increased the war bonus of its employés from 20s. per week to 23s. 6d.

Sheffield.—Generating Plant.—At a recent meeting of the Council, when the Electric Supply Committee's minutes came up for consideration, the chairman, with Mr. Warlow, a director of one of the large steel works, moved an addition, which he asked the Council to confirm, authorising the purchase of turbo-alternators, boilers, &c., a request which raised a protest by a member of the Council, who has previously attempted to retard the progress of electricity supply. This member pointed out that as the addition involved the expenditure of something like £700,000, further opportunities should have been afforded the full Council to discuss the matter. Moreover, he considered the expenditure unnecessary, seeing that the present demand for energy was being met with existing plant. "There is," he added, "no reason or excuse for putting out these orders at a price so extravagant and outrageous as to make it absolutely impossible for the Committee to supply the manufacturers of Sheffield with cheap electricity. The cost of the proposed order is nearly three times the pre-war figure, and the cost of producing electricity with a plant of that kind is bound to be prohibitive." He did not agree with people who had visions of unlimited prosperity after the war. It was pointed out in discussion that any further delay in the matter would probably mean paying still higher prices for the same requirements, and ultimately it was decided to sanction the expenditure, subject to the approval of the Finance Consultative Committee.

South Africa.—Johannesburg.—Plant Extension.—The Municipal Council has provided £10,000 for the purchase of a temporary steam generating plant, and is to invite tenders for the same.

South Shields.—Price Increase.—The E.C. has increased the charges for electricity for all purposes, except for public lighting and traction, by 20 per cent. from the end of the present quarter.

Willesden.—Year's Working.—The total income of the U.D.C. electricity department for the year ended March 31st last amounted to £51,644, and the expenditure to £37,516, including £26,769 for the purchase of energy in bulk and £10,747 for distribution costs, &c. Of the gross profit, instalments on loans absorbed £9,113 and interest £4,117, the net profit being £1,201. The capital expenditure during the year was £8,763, including £6,428 for mains and services and £1,920 for transformers, &c. Units sold increased from 5,990,685 to 7,603,956 (lighting, 1,607,648; power and heating, 5,887,103; public lighting, 109,205). The cost of the bulk supply was 0·845d. per unit, compared with 0·866d. in the previous year, and distribution costs were 0·128d., against 0·121d., while the total cost, including management expenses and capital charges, was 1·605d., against 1·719d. The maximum demand was 3,255·5 KW., against 2,826 KW. in the preceding year.

TRAMWAY AND RAILWAY NOTES.

Birkenhead.—Year's Working.—The annual report of the Corporation tramway department for the year ending March 31st last states that the income was £97,838, or £17,098 higher than the record made during the preceding 12 months. Traffic receipts were £96,386, an increase of £16,714; working expenses, £53,815, an increase of £11,708; the profit was £44,023, an increase of £5,382; interest on capital was £26,651, an increase of £1,662. Of the balance (£17,372, or an increase of £3,720) £8,550 went in aid of rates, £3,822 to reserve fund, and £5,000 to renewals funds, the former of which now stands at £12,013 and the latter at £39,338. Due to the increased price charged for electricity, the cost of electrical energy was £11,326, compared with £7,244 last year. War bonus being paid to employés is at the rate of £12,800, and war allowances to employés on active service amounted to £998 per annum. The passengers carried numbered 20,538,476, an increase of 2,588,043, excluding soldiers and sailors carried free of charge. The car-miles were 1,219,250, and number of units used per car-mile was 2·221. Net profit was £17,372, against £13,653.

Darwen.—Increased Fares.—The Corporation is applying to the B. of T. for power to raise the tramway fares beyond the limit allowed by the Corporation's 1899 Act.

Leeds.—Reconstruction.—The Tramways Committee proposes to reconstruct the tramway track in certain thoroughfares, and to attach the overhead wires to supports fixed on buildings, instead of to the poles in the middle of the streets, as at present in use.

Fares.—The Committee has refused an application from the Otley U.D.C. for a reduction of fares on the railless system between Otley and Guinsley.

London.—Women Tramway Workers.—The award of the Committee on Production in connection with the claims of the women tramway and omnibus workers for equal pay for equal work, was issued last week. It lays down that the wages of women aged 18 and over are to be increased by 5s. per week, subject to a maximum of 25s. per week over pre-war rates; payment to be on the basis of a week of six days or six shifts; the award to take effect from July 9th last; and the Committee recommends that the whole question of women's wages and advances should be the subject of a special inquiry.

The Government has appointed a Committee to investigate and report as to the relations which should exist between the wages of men and women, having regard to the interests of both, as well as

to the value of their work, and also having in view the necessity of output during the war, and the progress and well-being of industry in the future.

In view of the shortage of paper, the L.U.T. tramcars now have canvas bags fixed near the exits, in which passengers are requested to deposit their used tickets on leaving the cars.

New South Wales.—FARE REDUCTION.—Replying to a deputation asking for a reduction in fares, the Chief Commissioner for Railways stated that a reduction in fares would mean a serious loss in revenue, and the Department was not in a position to lose revenue. Passengers were carried at half the price charged in other countries. If the war continued, and the Commissioners were not able to get the material required for the construction of railway and tramway rolling stock, they might have to seriously restrict travelling. In New Zealand the authorities had cancelled all pleasure travel, and after 6 p.m. at night no trains were run at all. Something of the same kind might have to be done in New South Wales. It was also stated that electrical material could practically not be obtained. Wheels and tires had been all imported, and there was the greatest difficulty in replacing them when they wore out. Tires, particularly, were used up at a very rapid rate. The practice in condemning tires had been altered, otherwise the service would necessarily have been reduced by half. Strenuous efforts had been made to manufacture equipment locally. Pinions for motors, and also tires, were now being made in the railway workshops. They had also experimented with a chilled cast-iron wheel, but the result had been disastrous, as the wheels would not stand the traffic. Nearly half the tramway rolling stock was fitted with obsolete motors, the replacement of which would cost £250,000. The electrical plant was overstrained, and, naturally, breakdowns of appliances frequently took place. In the March quarter there was a decrease of 6·76 per cent. in passengers carried in comparison with the same quarter of 1917, and the reduction in car mileage amounted to 5·5 per cent. Relatively more car miles were run in comparison to passengers carried in the last quarter than in the 1917 quarter.

TELEGRAPH AND TELEPHONE NOTES.

American Marconi Decision.—The Marconi Wireless Telegraph Co. of America has appealed against the judgment in favour of the International Radio Telegraph Co., mentioned in our issue of August 23rd, and it is hoped that the decision will be reversed. We are informed that the amount involved is about £60,000, *i.e.*, about one-tenth of the amount which has been reported.

Canada.—At the request of the Labour Department, the Canadian Pacific telegraph operators have consented to submit their differences to the Board of Arbitration.

China.—It is reported that the Marconi Co. has signed a contract for a loan of £600,000, at 8 per cent. interest, on the security of Chinese Treasury bonds, repayment beginning in 1924 and ending in 1929. It is said that the company undertakes to provide China with 200 wireless telephones, transmitting 40 miles, but no official confirmation of this statement has been issued. China will employ an English expert.

According to *The Times* the company signed a contract on August 24th with the Chinese Ministry of War to supply 20 wireless telephones for military purposes, and the loan is half for the purchase of the telephones, half for unspecified expenditures.

Telephony in Sweden.—The A.B. Stockholmstelefon (formerly Allmanna Telefon) is to be taken over by the Swedish Telegraph Administration, and is thus to be amalgamated with the Rikstelefon (the State Telephone System). The sum to be paid by the Telegraph Administration for the acquisition of the entire telephone lines, plant, apparatus and materials of the A.B. Stockholmstelefon is about 47,000,000 kronor. A preliminary agreement on the above lines has been sanctioned by the Government, but its definitive conclusion depends on the Riksdag. The Stockholm Telephone Co., which has a capital of 18,000,000 kronor, serves Stockholm and the surrounding district. The local competition between this company and the State Telephone has been very severe, and the amalgamation of the two telephone systems has long been under consideration.—*Board of Trade Journal.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Atherton.—September 16th. U.D.C. Two 110-KW. single-phase transformers. See "Official Notices" August 30th.

Bristol.—September 26th. Electricity Committee. Six months' supply unwashed small coal. Chief Engineer & Manager, The Exchange, Corn Street.

London.—OFFICE OF WORKS.—September 12th. Electrical accessories. See "Official Notices" to-day.

September 16th. Supply of electric bell fittings. See "Official Notices" to-day.

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" August 23rd.

South Africa.—October 23rd. Union of South Africa. Department of Posts and Telegraphs. Copper wire, &c., telephone apparatus (bells, blocks, boxes, coils, protectors, rosettes, switches, switchboards, &c). Tenders to Union Tender Board, Union Buildings, Pretoria. Specifications, &c., may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

JOHANNESBURG.—September 16th. South African Railways and Harbours Administration. Supply, during 1919, of electrical cables and wires and bare copper wire (tender No. 163). A copy of the specification, &c., may be consulted by British manufacturers at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence).

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

2,500 condensers, £492.—British General Electric Co., Ltd.
2,500 circular dry cells, £194.—Western Electric Co. (Aust.), Ltd.

P.M.G.'s Department, Queensland :—

Telephone switchboard material, schedules 437 and 439, £505.—Western Electric Co. (Aust.), Ltd.
One ammeter and four meggers, schedule 439, £202.—H. Rowe & Co.

P.M.G.'s Department, Victoria :—

1,000 meter coils, £275.—Auto-Telephones (Aust.), Ltd.; 3,000 diaphrams and 1,100 jacks, £235.—J. Paton & Co.; automatic private branch telephone exchange equipment, £461.—Automatic Telephones (Aust.), Limited.

Victorian Railways Department :—

Supply of porcelain bus-bar insulators, £1 2s. 6d. each.—Australian Porcelain Co., Pty., Ltd.

Victorian State Coal Mine :—

Enamelled copper wire, No. 21 s.w.g., 5s. 6d. lb.; 31, 9s. 7d. lb.; 32, 10s. 6d. lb.; 33, 11s. lb.; 34, 12s. 6d. lb.; 36, 21s. 7d. lb.—British General Electric Co., Ltd.; ditto No. 18, 3s. 8d. lb.; 30, 5s. 8d. lb.; 37, 7s. 6d. lb.—Lawrence & Hanson, Pty., Ltd.

—*Tenders.*

Salford.—Lighting and Cleansing Committee. Charging switchboard and automatic cut-off, £58. Drake & Gorham, Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, September 6th. At 3.45 p.m. Visit to the British Scientific Products Exhibition, at King's College, Strand, W.C. 1.

(Midland Section).—Saturday, September 7th. At 3 p.m. Visit to the Boulton & Watt Collection of Engineering Exhibits, at the Reference Library, Birmingham.

(North-Eastern Section).—Tuesday, September 10th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "Electric Furnaces," by Mr. C. Bleakinsop.

Iron and Steel Institute.—Thursday, September 12th. At 10.30 a.m.; and Friday, September 13th. At 10 a.m. At the Institution of Civil Engineers, Great George Street, S.W. 1. Autumn meeting.

Institution of Mining Engineers.—Friday, September 13th. At 11.15 a.m. At University College, Nottingham. Annual general meeting. Presidential address.

Salford Technical and Engineering Association.—Saturday, September 14th. At 7 p.m. At the Royal Technical Institute. Paper on "Steam Turbines," by Mr. E. Lee.

NOTES.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 37, by Lieut.-Colonel C. B. Clay, V.D.:—
Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Monday, September 9th, to Saturday, September 14th.—Drills as usual.
Sunday, September 15th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Fatality.—At an inquest at Birmingham, on Monday, a verdict of "Accidental death" was returned in the case of W. H. Hearl, who was killed at the Wolseley Co.'s works, Adderley Park. While painting the ironwork of the roof on August 29th he put out his hand to replace a square wooden block that carried two of the electric wires, which was hanging loose. In doing so he received a shock and fell, breaking his neck.

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"ASTON" GASTIGHT SWITCH,

WITH TWO-PIN INTERLOCKED PLUG.

Designed for Aerodromes, Chemical Works, Shell-filling Factories and Fiery Mines.

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Plug Contacts are in separate Chamber.

The Plug cannot be inserted the wrong way or withdrawn while current is on.

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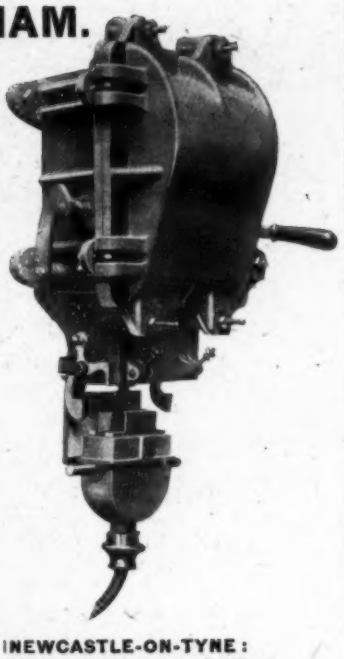

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BIRMINGHAM: Phœnix Chambers, Colmore Row.
BRISTOL: 59, Victoria Street.
MANCHESTER: Hardman Street, Deansgate.
NEWCASTLE-ON-TYNE: Edinburgh Life Assurance Buildings, 21, Mosley Street.
GLASGOW: 51, Waterloo Street.
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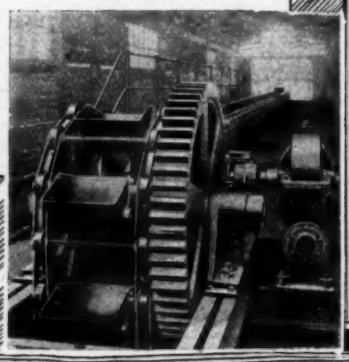

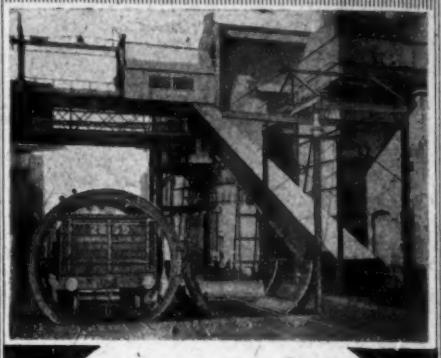

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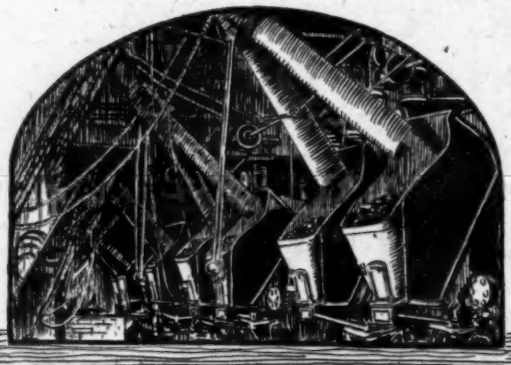

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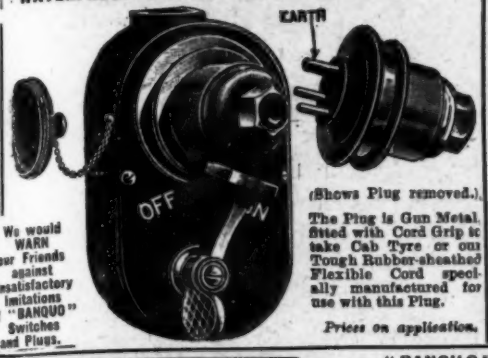

(Shows Plug removed.)

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5/0	9/4	14/-	18/8	23/4	28/-	32/8	37/4	42/-	46/8	51/4	56/-

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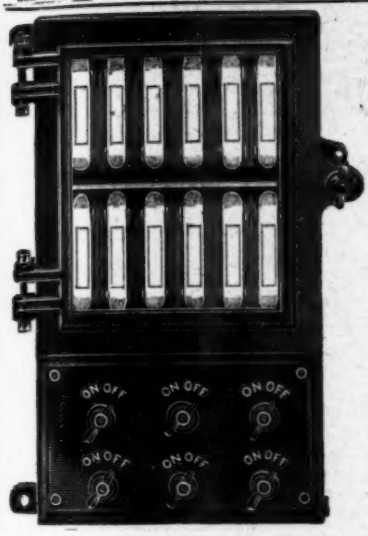

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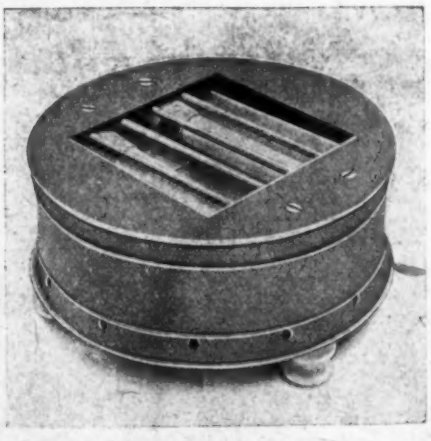

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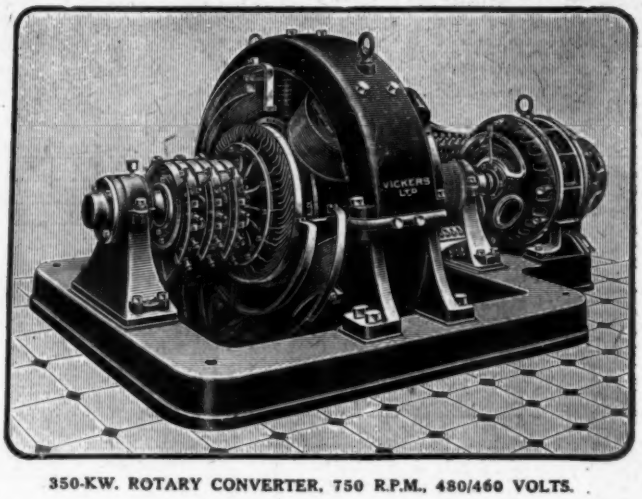

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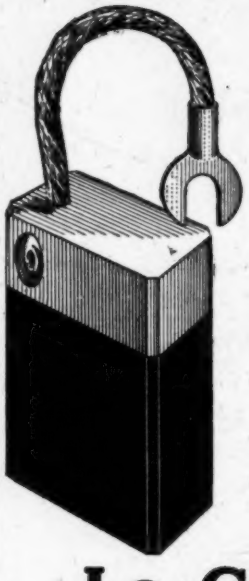

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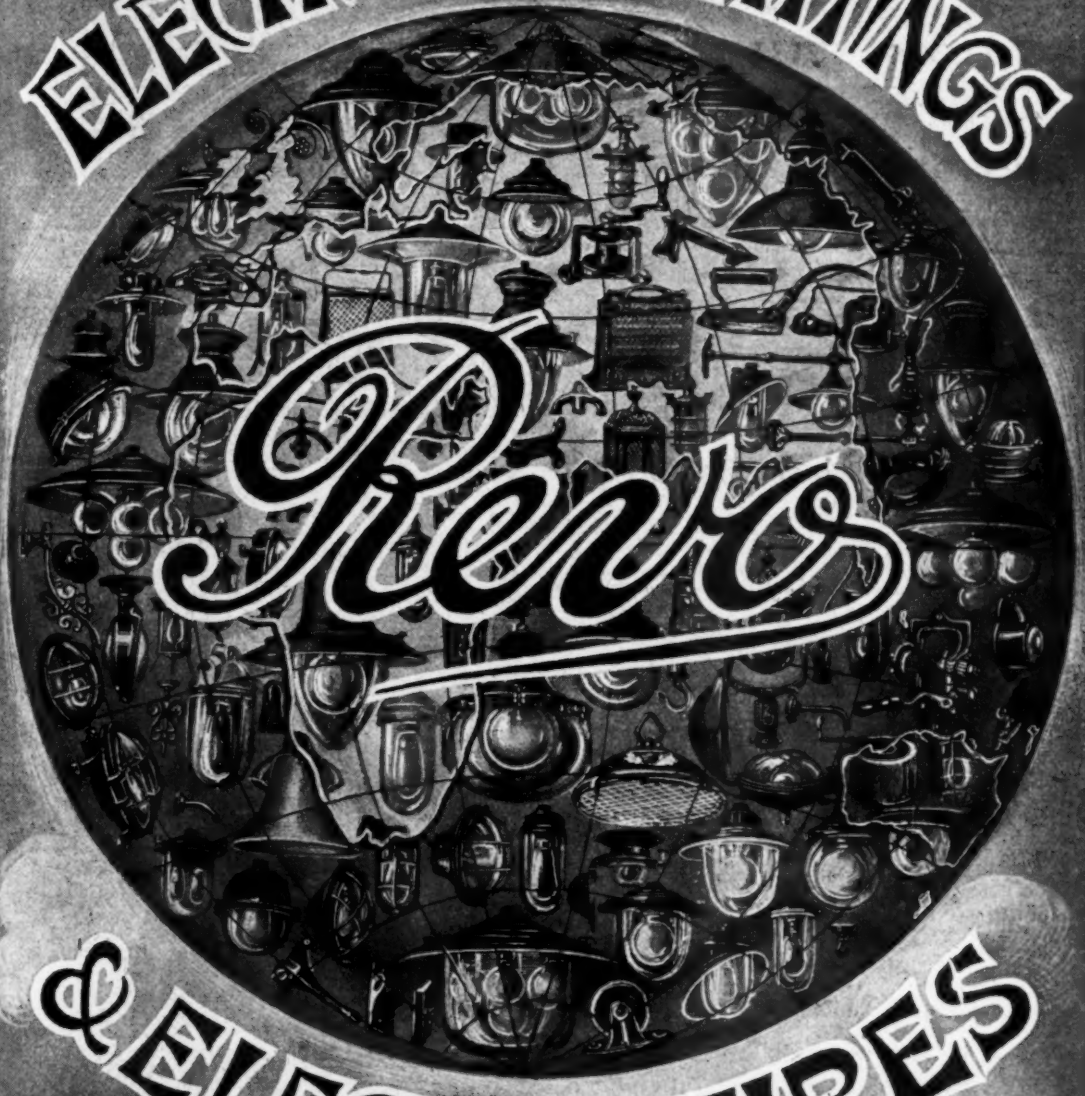

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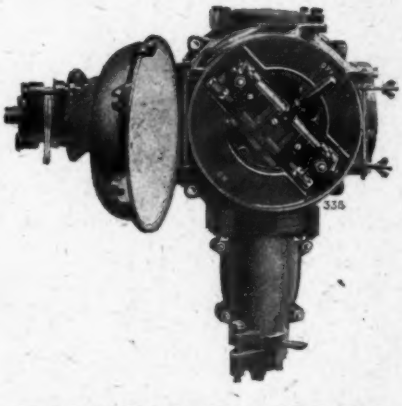

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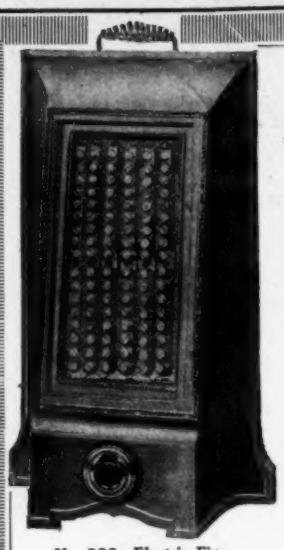

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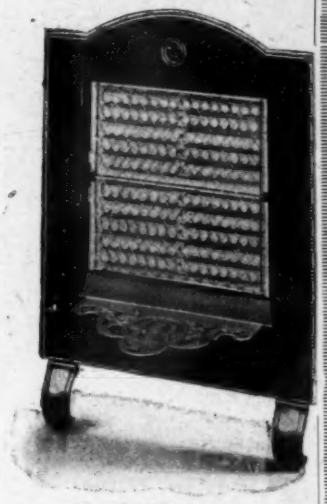

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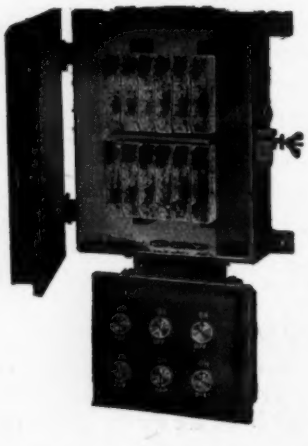

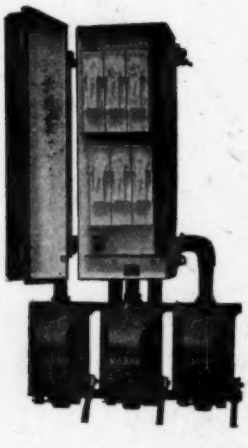

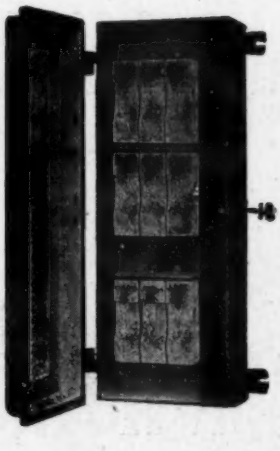

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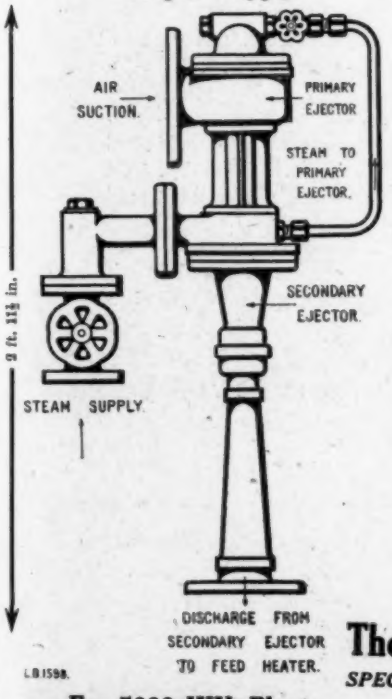
"Simple" Type.



For 5000 KW. Plant.
Weight 97 lbs.
Operating Steam 880 lbs. per hour.

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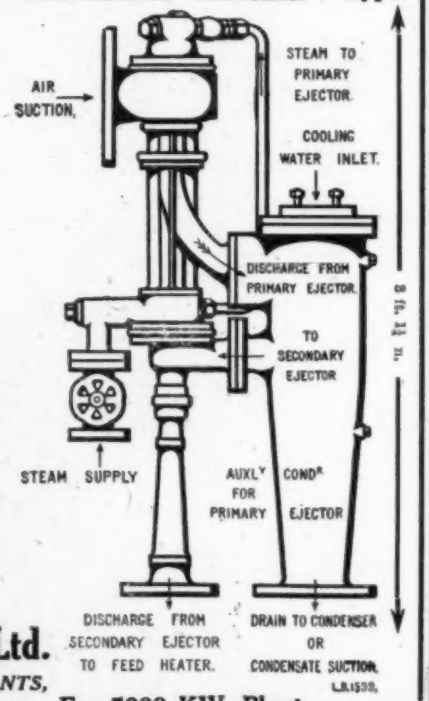
Write us for advice as to which type is most suitable for *your* conditions.

"Intermediate Condenser" Type.



For 5000 KW. Plant.
Weight 200 lbs.
Operating Steam 400 lbs. per hour.

The Mirrlees Watson Co., Ltd.

SPECIALISTS IN CONDENSING PLANTS,

Glasgow.

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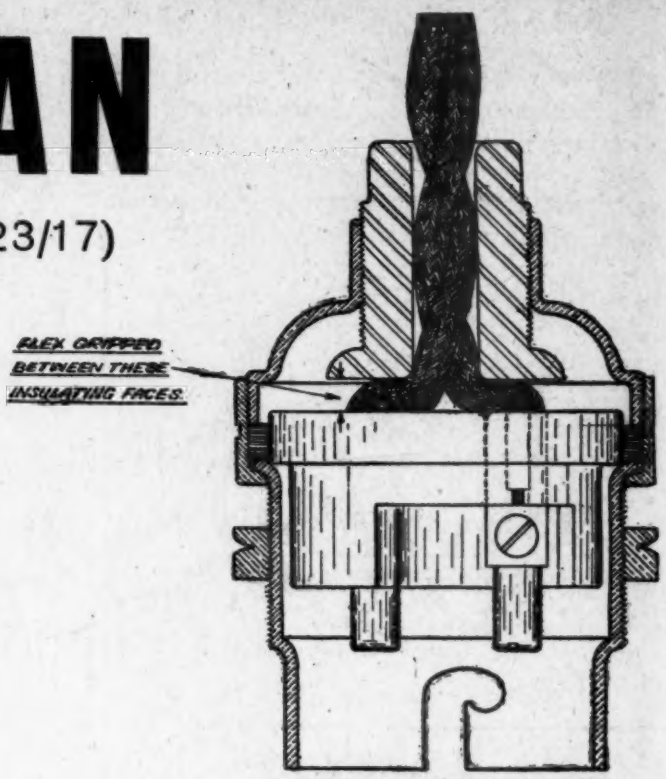
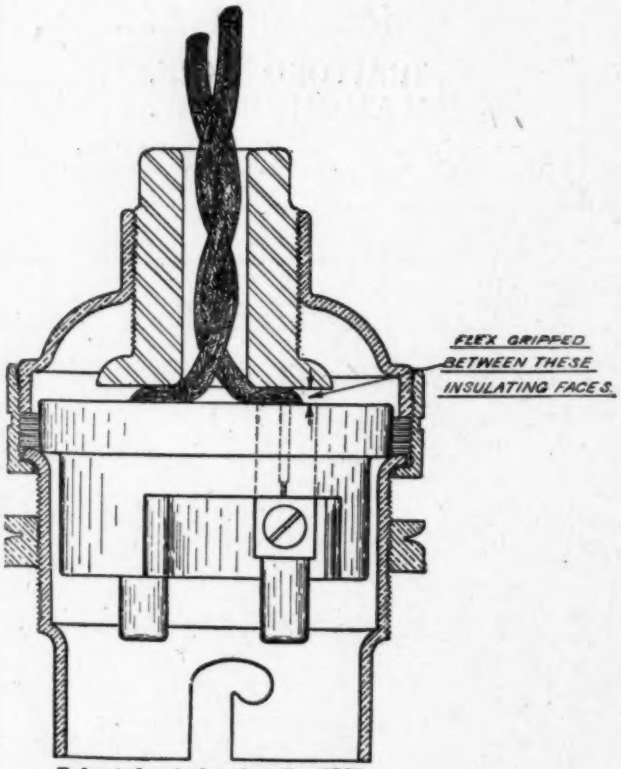
(Lamlok Patent 10423/17)

NEW CORD GRIP



Enlarged cut showing the GRIP in use with a THICK FLEXIBLE.



Enlarged cut showing the GRIP in use with a THIN FLEXIBLE.

SPECIAL FEATURES.—This Grip has been designed for converting Standard ½-in. or ⅝-in. Female Thread Holders (with or without Shade Carrier Rings) into Efficient Cord Grip Holders.

It will be seen from the drawings that the Flexible (either thick or thin variety) is efficiently and harmlessly gripped between two insulating surfaces, the Holder Porcelain and the interior of the Insulating Material Grip itself (the latter being adjustable to suit varying thicknesses of flexible) and held as in a vice without, however, any chance of injury at the time of installation or later to the insulation of the conductor.

The hole through the grip being large, the flexible is "free" at the outlet, so that breaking at this point is entirely obviated and short circuits thus avoided—a constant source of trouble with the standard Brass-and-Wood-Grip.

Time and annoyance is saved in wiring, in that the paring of the grips (a tedious and lengthy process making for inefficiency) is entirely avoided.

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SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

COUNTY BOROUGH OF SALFORD.

Electricity Department.

APPLICATIONS are invited for the position of Boiler House Superintendent to take charge of Lancashire and Water-tube Boilers, including operation and maintenance. Applicants must have practical knowledge of boiler house operation and be able to carry out efficiency tests and the testing of fuel.

Applications, stating age, qualifications, and salary, to be forwarded to the BOROUGH ELECTRICAL ENGINEER, Frederick Road, Salford, not later than MONDAY, SEPTEMBER 16th, 1918.

L. C. EVANS,
Town Clerk. 2486

MAINS ASSISTANT.

MAINS ASSISTANT wanted with experience in High and Low Tension work, energetic. Salary £3 per week with 20s. plus 12½ % bonus. Apply, giving particulars to—

MANAGER,
Electricity Works,
Croydon. 2476

SHIFT ENGINEER.

SHIFT ENGINEER wanted for certified undertaking (municipal). Must have had good electrical and mechanical experience. Wages £3 10s. to £3 15s. per week (inclusive of all bonuses), according to qualifications.

Applications, stating age, experience, when at liberty, &c., with copies of recent testimonials, to be addressed to 2506, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SHIFT ENGINEER.

SHIFT ENGINEER required in 3-wire D.C. station; must have had Diesel and steam experience.

Apply with references, stating age and salary required, to ENGINEER, Electricity Works, Tonbridge. 2507

SITUATIONS VACANT.—*Continued.*

SHIFT ENGINEER.

SHIFT ENGINEER wanted for certified undertaking. Must have good experience with Steam Plant and E.H.T. Rotary Converting Plant, and proper technical training. Salary £192 per annum inclusive for all time worked.

Apply, stating particulars of age, training, &c., and copies of recent testimonials, to 2321, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

WIRELESS TELEGRAPHY.

WANTED immediately, thoroughly efficient man with initiative, to take charge of electrical and physical tests of wireless telegraph apparatus, parts and materials. Would also be required to act in an advisory capacity for a series of factory test rooms. Applicants must have had previous experience in a similar position.

Write, stating salary and qualifications in full, to 2514, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT wanted for Combined D.C. and Three-phase Station (certified undertaking).

Apply, with particulars of training, experience, age, military service, position and salary expected, to ELECTRICITY DEPARTMENT, Dudhope Crescent Road, Dundee. 2490

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ARMATURE Winder and Repairer, good improver, used to A.C. and D.C.; Stratford shop; preference given to ex-service man; good wages and permanency to suitable applicant. No person resident more than 10 miles away, or already on Government work, will be engaged.—JAMES EVANS & Co., Palatine Works, Gibbins Road, Stratford, E. 2461

ARMATURE Winder required for D.C. repairs in the Midlands (Controlled Works). No person already employed on Government work will be engaged.—Apply, stating age, experience, and wages for 53-hour week, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5940. 2442

ARMATURE Winder wanted for repair work in East London. No one residing more than 10 miles distant, or at present on Government work, need apply.—5403, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ARMATURE Winders, used to D.C. and A.C. repairs and rewinds, also switchboard and controller hands. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5944. 2457

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Engineer, wanted for London central station, salary, including bonus, £259 and residence.—Full particulars, to 5353, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer wanted for small undertaking; capable of executing repairs on consumers' premises and mains work. Knowledge of Diesel engines preferred. Salary £150. Must be low category.—2470, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Estimating Engineer required immediately for control gear sales department, electric engineering work. South Coast.—Apply, stating age, qualifications, and salary required, to 2399, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CAPABLE Test Room Assistant wanted. Experience with contactor gear an advantage but not essential, good prospects if suitable. No person already on Government work will be engaged.—Apply, giving full particulars of experience and wages required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5824. 2265

CHARGE Engineer wanted for D.C. station, gas and steam, £166 per year, plus 12½ per cent. war bonus.—Experience and testimonials to BOROUGH ELECTRICAL ENGINEER, Weymouth. 2515

CHIEF of Test Room wanted, with first-class experience in calibration, and testing of moving coil and moving iron instruments; must be energetic, capable of getting work through quickly, and able to train female labour. No person already on Government work will be engaged.—State age, qualifications, experience and salary expected, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5595. 2487

CLERK required by firm of Electrical Engineers, with knowledge of book-keeping, shorthand, typing, &c.; applicant with electrical knowledge preferred. No one on Government work, or living more than 10 miles away, need apply.—State age and wages required, to 5476, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

COMMERCIAL Engineer wanted at once in London Export office handling electrical and automobile equipment and accessories, preferably with knowledge of French or Spanish, present export restrictions, and with good connection. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write stating age, experience and salary required, W. B. S., c/o Morris, Russell & Co., Ltd., 75, Curtain Road, E.C. 2. 2462

CONTROLLED Electrical Firm in the Midlands requires Man, with sound technical education, to carry out candle-power, and other electrical and physical tests; permanency for suitable man. No person already on Government work will be engaged.—Apply, stating experience, age, military position and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5949. 2460

DESIGN Department, North of England firm, requires Assistant with knowledge of either D.C. or A.C. machine design. Applicant must be over 25 years of age and preferably of low category. No person already employed on Government work will be engaged. —Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5950. 2465

DISTRICT Engineer required, experienced in O.H. line work, and with good knowledge of plant on consumers' premises, &c.—Apply, stating all particulars and wage required, to SCOTTISH CENTRAL ELECTRIC POWER CO., 1, Kirk Wynd, Falkirk. 2472

DRAUGHTSMAN, with experience in the design of Switchgear. Progressive permanent position for the right man. Discharged man preferred. No one already on Government work, or living over 10 miles from Charing Cross, need apply.—State experience, salary and age. to 2379, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMEN wanted, preferably used to H.T. and L.T. switchboard work; London district. No person resident more than 10 miles away, or already on Government work, will be engaged.—2368, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Motor Mechanic, experienced in repairs to small motors; permanent progressive job for the right man. State age, experience and wages required. No person resident more than 10 miles away, or already on Government work, will be engaged.—2256, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Vehicle Garage and Battery Depôt (London).—An Electrician with an all-round experience, including accumulators and machines (D.C. and A.C.), is required as Working Foreman; rate 1s. 3d. per hour, plus 3s. war bonus, plus 12½ per cent. No person resident more than 10 miles away, or already employed on Government work, will be engaged.—2383, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Fitter wanted used to central-station switchgear and repair work; standard rate of wages.—Apply, with full particulars of experience, stating age, and enclose copies of testimonials, to NORTHAMPTON ELECTRIC LIGHT & POWER CO., LTD. 2423

ELECTRICAL Wireman wanted (Warrington district); only first-class man for screwed, tubing and general work. Manchester rate. Give full particulars of previous employment. Government work. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No A5896. 2373

ELECTRICAL Wiremen and Switchboard Attendants, required for a large Controlled Works power house in the Midlands. No person already employed on Government work will be engaged. —Apply, stating age, experience, and wages required for 53-hour week, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5939. 2444

ELECTRICIANS required for maintenance and war work.—Apply THE HENDON ELECTRIC SUPPLY CO., LTD., 43, Golders Green Road, N.W. 4. 2478

ENGINEER wanted to take charge of small country town installation (south coast), oil and gas engines, battery, underground and overhead mains, 150 consumers, about 40-KW. maximum load. Wages 56s. per week, including bonuses.—Apply, stating age and experience, to E. LL. INGRAM, St. Osmund's Road, Parkstone, Dorset. 5429

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER required for Boiler House Maintenance in large power station (certified undertaking); water-tube boilers. Man with marine or power station experience preferred. Wages paid over standard rate.—Apply POWER STATION, Downing Street, Smethwick. 2480

FITTER-Driver required for 1,000-KW. D.C. Power Station in Government Controlled Establishment. Must have good experience with Corliss engines and Lancashire Boilers. Permanent situation to qualified and capable man. No person already on Government work will be engaged.—Applicants are requested to give full particulars of apprenticeship, training, experience and wages required, to their nearest EMPLOYMENT EXCHANGE, quoting reference No. A5903. 2387

SITUATIONS VACANT.—*Continued.*

FOREMAN Winder wanted for repair work, near Glasgow; must be a practical man with experience of A.C. and D.C. work for Collieries; permanent position for suitable man. No person already employed on Government work will be engaged.—Apply, stating age, experience and wage required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5952. 2469

IMPROVER required for three-wire D.C. station (Certified Undertaking), must have good theoretical training.—Apply, stating age, experience, salary required.—ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2380

IMPROVER wanted for 3-wire D.C. Corporation electrical works. —Apply in first instance, stating age, experience and salary required, together with copies of testimonials, to 2448, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JOINTER wanted for certified undertaking, used to E.H.T. and L.T cables.—Apply, stating wages, experience, &c., to WILLIAM C. BEXON, Engineer and Manager, Electricity Works, Kilmarnock. 2463

LIFT Engineering. An old-established London firm, manufacturing electric lifts, have opening for energetic young man with thorough technical and commercial experience of lift business, with view to partnership. No person resident more than 10 miles away, or already on Government work, will be engaged.—In first place, write fully, in strict confidence, to E. S. DAVIDSON, Atlantic House, Holborn Viaduct, E.C. 2407

LINESMAN, for E.H.T. overhead work, permanent job.—Apply, stating age, experience. wages, &c., to 2473, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MECHANICAL Foreman required for London Suburban Power Station. Must have good experience with Bellis engines and water tube boilers. Good wages paid to suitable man.—Applications, which shall be in strict confidence, should give particulars of training, experience and wages, to 2479, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PATENT Agency.—Wanted a competent man (ineligible), as Electrical Engineer Assistant, in the business of patent agency in a large office in London; should possess Degree or Diploma of Technical College.—Apply, with details of training and experience, and statement of salary expected, to Box 727, Reynell's, 44, Chancery Lane. W.C. 2. 5441

QUALIFIED Meter Testers required. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5394

SHIFT Engineer for Certified Undertaking, alternating-current supply, near London. High-speed engines. turbines, water-tube boilers, and usual auxiliaries. Commencing salary £182 per annum. Permanent job for suitable man.—2508, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required for three-wire D.C. and H.T. A.C. certified establishment; wages including all bonuses 62s. per week.—Apply. stating age and experience, 2451, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

STENOGRAPHER-Book-keeper. — Please reply, stating age, wages and full details of experience. No person resident more than 10 miles away, or already on Government work, will be engaged.—LANDIS & GYR, LTD., Hampton Hill. 2481

STOREKEEPER and Cost Clerk.—Please reply, stating age, wages, and full details of experience. No person resident more than 10 miles away, or already on Government work, will be engaged.—STONEBRIDGE ELECTRICAL COMPANY, Hampton Hill. 2482

STORES and Material Clerk, wanted for electrical engineers and contractors. Smart intelligent man only. Discharged soldier would have preference. State if any previous experience, references, and wages required. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5917. 2484

SWITCHBOARD Attendant for power station near London. Experienced with D.C. 3-wire plant and batteries.—State union rate of wages required. age, theoretical and mechanical training, military category, with copies of testimonials, to 5419, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant required for 3-wire station with tramways. No night shift. Wages £3 7s. 6d. per week.—Apply MANAGER, Weston-super-Mare Electric Supply Co., Locking Road, Weston-super-Mare. 5482

SWITCHBOARD Attendant wanted for Central Station.—State age, wages required and full particulars of training, &c., and enclosing copies of testimonials, to 2447, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

SWITCHBOARD Driver for D.C. station (certified undertaking), gas and Diesel engines.—Apply, stating experience and wages required, ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2382

TESTER required for electrical switchgear works. No person already employed on Government work will be engaged.—Reply, stating particulars of experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5938. 2489

THE Directors of a large Engineering Firm in the West Riding of Yorkshire are open to appoint a Gentleman with high-class engineering and business experience to occupy the post of Commercial Manager, such position to carry a seat on the Directorate of the Company.—Applications will be treated in confidence and should be addressed to 5459, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at once for London station, Fitter with turbine and general station experience. Standard rates of pay.—2436, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at once, Leading Wiremen and Wiremen for temporary work on Government buildings in London. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply SAMUEL REED & SONS, 136, Great Dover Street, S.E. 1. 5451

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, experienced Diesel Engine Drivers; also Shift Engineers, with knowledge of A.C. and D.C. station work; men willing to train for above should also apply.—ELECTRICITY WORKS, Leatherhead. 5383

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED immediately, Cable Jointer for high-tension and low-tension paper-insulated Cables. Must be capable of doing own plumbing. Wages 73s. 2d. for 52½ hours, including all bonuses and allowances.—ST. HELENS CORPORATION ELECTRIC SUPPLY DEPARTMENT, Electric Power Station, Carlton Street, St. Helens. 2400

WANTED in the power house of a large Controlled Works in the Midlands, a good Fitter for engine and general plant repairs. Must be used to a lathe. No person already employed on Government work will be engaged.—Apply, stating age, experience and wages required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5941. 2443

WANTED, Man used to running simple steam engine and dynamo, for house near Guildford. No person resident more than 10 miles away, or already on Government work, will be engaged.—SUNDERLAND, 47, Victoria Street, S.W. 1. 2467

WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, skilled Switchboard Attendant for high-tension rotary sub-station. Wage for 56-hour week, including all bonuses, £3 10s. 6d.—Applications, giving particulars of experience and when duties can be commenced, to the GENERAL MANAGER, Corporation Electricity Department, Dunning Street, Sunderland. 2446

WANTED, smart Boys, with experience lights and bells. No person resident more than 10 miles away, or already on Government work, will be engaged.—ELECTRIC LIGHT INSURANCE AND MAINTENANCE CO., LTD., Rupert Court, Rupert Street, W. 1. 5479

WIREMAN wanted, permanency, electricity undertaking in the Midlands; rate 1s. 3d. per hour, including all bonuses.—Reply, stating age and experience, to 2450, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Manager wanted, must have good experience in accurate production of parts on Capstans, Milling Machines, Presses, &c., for electrical parts in brass and insulating materials. Salary for really good man, £450 with prospects of increase. No person already on Government work, or living more than 10 miles away, engaged.—Replies in confidence, stating experience, to 2386, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

APPOINTMENT FILLED.

VACANCY for Junior Assistant, Fife Electric Power Co., advertised in ELECTRICAL REVIEW, 16th and 23rd August, has been filled. Applicants are thanked. 2504

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A.A.—ELECTRICAL and Mechanical Engineer (35), A.M.I.C.E., 16 years' experience of large plant, erection and power works running, is able to devote several hours daily to technical or commercial work. First-class technical ability in both steam and electricity; good business organiser and pushing personality. Would like to be engaged in London District on the preparatory steps for whole-time business drive after war.—5486, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, Engineer and Manager, Electric Lighting and Power Station, desires change. 16 years' experience in erection and maintenance of plant and mains, and accustomed to the control of men. Commencing salary £260.—5334, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, Manager to large firm of Electrical Contractors, shortly at liberty, desires similar position; thoroughly experienced in modern lighting and power schemes.—5481, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER seeks change, thoroughly experienced in estimating, preparing lay-out, buying, and generally supervising Admiralty and Mercantile ship installations, also power and lighting ashore; Government work on Clyde preferred.—5328, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER seeks responsible position, extensive skilled, practical, technical, and commercial experience; formerly managing engineer leading London contractors; also own business; over military age. £220; eminent references.—5418, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, with considerable experience in lift and crane erection and repair; would join another in repair business. Could provide small capital and find work.—5388, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A.M.I.E.E. (age 37), ineligible for H.M. forces, experienced in maintenance and running of mechanical transport (steam and petrol), seeks position, commercial side preferred.—5456, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer desires an appointment; over 12 years' experience in the generation and distribution of electrical energy.—5311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BUYER, keen and businesslike, desires change, first-class electrical and mechanical experience, used to detailed work, storekeeping, shops and drawing office training.—5450, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHIEF Clerk (ineligible), many years electricity and tramway undertaking; also varied accountancy and costing experience, including motor-'bus department, desires change.—5331, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COLLIERY Head Lampman, Electric Lamps, desires change; first-class man do all repairs, had maker's experience in charge of one of the most successful cabins in the country, Creag and Oldhams.—5465, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTORS' Electrical Engineer, eight years' experience in low-tension and extra-high-tension cable laying and overhead line contracts; well up in power installation work in mills, and lighting distritbuions for camps; can handle large gangs of men, and get contracts through against time.—5405, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN (discharged) desires position; first-class experience in the design of A.C. and D.C. motors and generators, and electric lifts; certificates from the Manchester School of Technology; age 31.—5449, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, with experience in E.H.T. and D.C. gear, desires position as assistant estimating engineer or leading position in D.O.—5401, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer desires change; 24 years' experience in all branches, installing, running, managing, installations, Diesel, gas, suction gas, oil, petrol engines, motors, dynamos, accumulators, automatic lifts, automatic telephone exchange and telephone systems, power, lighting, steam, hot and cold water, drainage systems. Good commercial experience, organise and control labour. Factory, institution, hospital, or Government works. Salary £300.—5485, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer desires post in charge of installation. Thoroughly experienced A.C. and D.C., lighting, power, lifts, cranes, 'phones, &c. At home or abroad.—5484, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (discharged) desires change; 17 years' experience installation and plant work, estimating and supervising. South preferred.—State wages to 5468, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ELECTRICAL Engineer (Grade III) first-class theoretical training; eleven years' practical experience in manufacture, test room and installation of electrical machinery requires post.—5369, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (30) College Graduate, nine years' technical and commercial experience, desires change; salary £400 permanent post.—5448, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, maintenance, good all-round hand, electric lifts, cranes, motors, rotaries; ineligible.—5389, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, nine years' power station experience, D.C. supply, experienced in batteries, dynamos, wiring, &c.; thoroughly conversant with steam and internal combustion engines; West Country preferred; army discharge final.—5361, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN requires permanency; used to erection and maintenance of factory and works plant.—5464, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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(Continued on next page.)

FOR SALE.—*Continued.*

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(*Continued on next page.*)

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(Continued on next page.)

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44-KW., 110-volt D.C. Generator, compound wound, three-bearing type, with rope pulley and slide rails; speed, 600.—DRUMMOND & Co., Middlesbrough. 5306

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500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery.—HARRY H. GARDAM & Co., LTD., Staines. 1851

500-KW. Steam Set, comprising triple-expansion enclosed engine, coupled to Westinghouse multipolar generator, 440/490 volts, D.C. For prompt delivery.—HARRY H. GARDAM AND Co., LTD., Staines. 1413

750-KW., 3,300-volt, 50-period, 3-phase, 250-R.P.M., engine type Alternator, by Westinghouse, suitable for direct coupling to engine, or would make good synchronous motor.—2396, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

20,000 FLAME Arc Lamp Carbons, 6 m/m to 12 m/m diameter, 12 to 25½ inches long, metal cored and non-metal cored. by Siemens, to be sold cheap. Also 500 Searchlight Carbons, 33 m/m to 10 inches, cored.—LAKE, 132, Upper Thames Street, London, E.C. 4. 5472

ARTICLES WANTED.

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6,000 CARBON FILAMENT ELECTRIC LAMPS, pear shape, plain, wanted for re-sale; Dutch make or otherwise. State rock bottom for spot cash, delivered free to north of England.

Quantity.					
216	...	220 volts	...	25 C.P.
1,850	...	220 ,,	...	32 ,,
1,050	...	220 ,,	...	50 ,,
750	...	230 ,,	...	32 ,,
48	...	240 ,,	...	25 ,,
48	...	240 ,,	...	50 ,,
1,250	...	250 ,,	...	32 ,,
48	...	250 ,,	...	50 ,,

What have you to offer? Write fully.
5435, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

ARTICLES WANTED.—*Continued.*

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ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone: Dalston, 555. Telegrams: Secondhand, Lowclap, London. Established 1860. 4358

A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 5391

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 5392

A 1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

BATTERY, new or second-hand, wanted, 50 or 100 volts, about 200 to 300 ampere-hour capacity.—5480, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 5158

GENERATORS, one or two wanted, 60/70 volts, 400/500 amps. D.C. Fullest particulars, lowest terms.—TILNEY, Olympia, Newport. 5457

NEW or Second-hand Tubing and Fittings wanted.—WALLACE, 58, High Street, Bloomsbury. 2307

OIL-driven Electric Light Plant wanted, 100 or 50 volts, with battery complete, about 200 to 300 ampere-hours capacity.—5424, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OLD Cable urgently required, also Lamp Tops.—WALLACE, Cromwell House, High Holborn. 4114

OLD Electric Lamps that have had wire-drawn tungsten filaments in them with glass parts intact, 1½d. each, any make.—104, Craven Park, London, N.W. 10. 5049

OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

SMALL Complete Lighting Set required, with engine, dynamo, accumulators, &c.; also extra set, small accumulators, and some old plates.—2349, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SURPLUS Stocks Electric Cable, Plant, &c., bought for cash; also scrap cable, dynamos, motors, cells, scrap metals, lamp ends, &c.—LAKE, 132, Upper Thames Street, London, E.C. 5473

WANTED, a few 200-volt, 50-period, single-phase Motors, slip-ring type, with starting gear; any size between 5 and 25 H.P.—2492, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at once for important Colliery, one 80/100-H.P., 500/600-R.P.M., 460/500-volt, D.C. Motor, and one 15/18-H.P., 800/1000-R.P.M., 460/500-volt, D.C. Motor; five panels for 100 to 300 amps., 500-volt, D.C.; three 8" H.P. Steam Stop Valves; Weir Feed pump, 3000 galls. hour, 120 lbs. steam. Good second-hand plant considered; P4. certificate available.—Fullest particulars to MCLAY, 10, North Parade, West Park, Leeds. 5382

WANTED, Direct-Coupled Steam Set, any output from 50/100 KW., will be considered; 440/480 volts, D.C.—State full details, price and where seen, to 2311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

WANTED, Electric Cooking and Heating Apparatus, Kettles, Irons, Vacuum Cleaners, all voltages. Also Electric Bells, Lamps and Arc Lamp Carbons, and all classes of Accessories and Flexibles. — Fullest particulars to 2316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Generating Set, 500 volts, 50 periods, 3-phase, 100 to 200-KW., Belliss or Browett engine preferred, but would consider other good make.—2494, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Generating Sets, all sizes, Boilers, Accumulators, Dynamos, &c., for export: also Scrap Cable and Metals. Complete plants purchased.—WILLIAMS & SONS 37, Queen Victoria Street, London. Telephone: 3938 City. 7000

WANTED immediately, one or more 80 to 100-B.H.P., 2-phase, 50-cycle, 220 or 440-volt Motors. New or second-hand from stock.—DAVIS, 11, Sun Street, E.C. 2. 5460

WANTED, Motor-Generator, output 3/5 KW., for 100/150 volts, D.C. Price must accompany offer.—2434, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, 400 volts, one-phase, or 200 volts, two-phase, to about 70 volts, 80 amps.; also one 440 volts, D.C., ditto.—R. F. WINDER, Cross Belgrave Street, Leeds. 2360

WANTED, Megger Set or Ohmmeter and Generator, 500 volts. Lowest price.—5413, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one or two large, slow-speed, 2700-volt, 2-phase, 50-period Motors for rolling mill work.—2495, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one 600/800-amp., 50/60-volt D.C. Generator. Also one 600/800-amp., 50/60-volt, single-phase Alternator, 50 periods, with exciter.—JOHNSON, MATTHEY & CO., LTD., Hatton Garden, London, E.C. 1. 2297

WANTED, Petrol Engine, direct coupled to dynamo, complete with switchboard, suitable for charging 27 cells at 40 amp. normal rate.—5488, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Saw Bench, with 36 and 30-in. saws and pulley, with or without 10-H.P., 480-volt, D.C. Motor, for belt-drive. —2468, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 10 or 12-H.P., 220-volt, 3-phase, 50-period Motor, also D.C. Generator, 110 volts, about 60 amperes, must be in good condition and ready for work. State lowest terms.—5467, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 200-220 V. D.C. Motor, with Starter, 1 to 2 H.P.— Full particulars, COLEMAN'S GARAGE, Carlow. 5445

WANTED, 200 to 250-H.P., 440-volt, 40-period, 3-phase, 365 R.P.M. Motor, suitable for direct coupling to air compressor. —2496, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 220-volt, direct-current Motors, moderate speed, 10 to 80 H.P.: quick delivery essential.—2493, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 240-volt, 30-in. Box Blade Fan, D.C.—FELGATE ELECTRICAL CO., 9, Merchant's Place, Reading. 5439

2-H.P. single-phase Motor at 1000—50 periods, 220 V.; also 2 H.P. 250 V., 25 periods.—A. BARRON & CO., Eastern Boulevard, Leicester. 5444

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FIRM of Engineers having considerable market for Electrical Machinery, whose intention it is to erect Works for its manufacture as soon as war conditions permit, desire to associate for this purpose with a view to earlier and larger development than would be possible on their own resources alone, with either another Firm manufacturing plant of this nature who are desirous of extending, or with a firm or persons prepared to back such an undertaking financially. Favourable site with cheap power for Works in large industrial district already selected.

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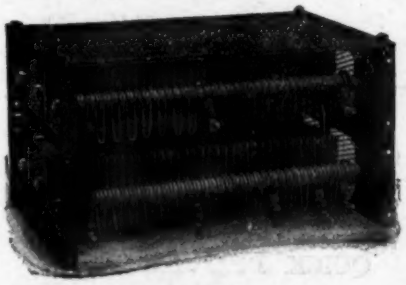

Sole Makers: THE
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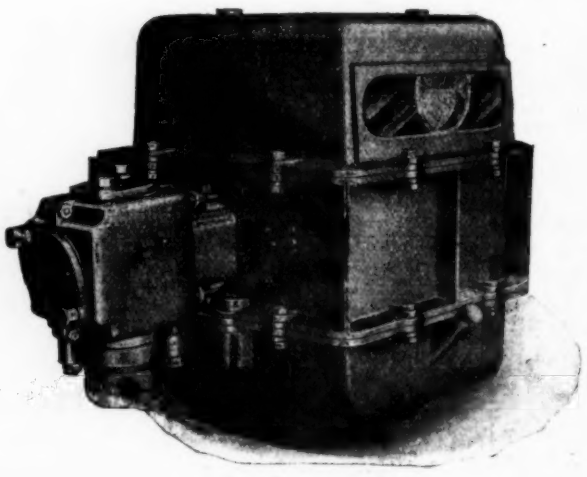

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The ELECTRICAL REVIEW is the recognised Medium of the Electrical Trades, and has BY FAR THE LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

NOTICES RELATING TO PATENTS.

Latest time for receiving 9.30 a.m. Thursday.

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Queen Anne's Chambers, 28, The Broadway, Westminster, S.W.1. **Chartered Patent Agent.**

THE PROPRIETOR of British Patent No. 22779/11, dated October 16th, 1911, for "Improvements relating to Electric Incandescent Lamps," is desirous of entering into arrangements, by way of a licence or otherwise on reasonable terms, for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.

All inquiries to be addressed to—

B. SINGER, 29, So. La Salle Street, Chicago, Illinois. 2416

PATENTS AND DESIGNS ACTS, 1907-14.

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THE PROPRIETOR of British Letters Patent No. 17,345, of 1913, is prepared to sell the patent or to license British manufacturers to work under it. It relates to an Electric Cut-out in which there is a U-shaped fuse strip mounted in an insulating block removably connected to the switch arm. Address :—

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THE COMMISSIONERS OF HIS MAJESTY'S WORKS, &c., are prepared to receive Tenders before 11 a.m. on THURSDAY, 12th SEPTEMBER, 1918, addressed to the SECRETARY, H.M. Office of Works, Storey's Gate, London, S.W. 1, for the supply of Electrical Accessories.

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TENDERS.

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Vice-Principal: E. M. WRONG, M.A. (Fellow Magdalen Coll., Oxford).

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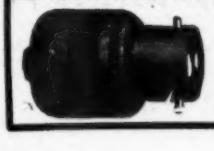

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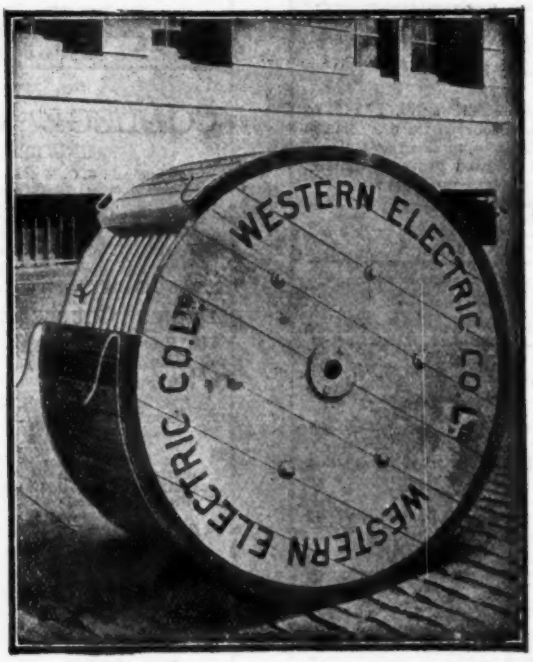

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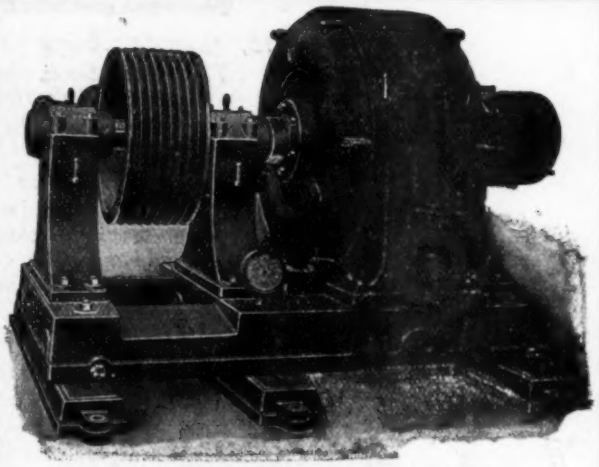

PATENT 3-PHASE, 2-SPEED CASCADE INDUCTION MOTOR FOR DRIVING COMPRESSOR AT ONE OF H.M. FACTORIES.

OUTPUT: 125 B.H.P. at 288 R.P.M.
" 83·5 " at 193 "
420 VOLTS. 50 CYCLES, 3 PHASE.

STEAM OR ELECTRICALLY-DRIVEN HAULING AND WINDING ENGINES, ALL SIZES.

MINING AND ELECTRICAL MACHINERY MANUFACTURERS.

BRITISH
ALL THROUGH

Start using "Sun Everything Electrical" service to-day.

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IT is doubtful whether any Key industry in any degree approaches Electricity and its applications in value to the community at large. In peace or in war no enterprise can go far without calling for its aid in some form to enable it to carry on effectively, efficiently and economically. These demands cover an enormously wide field, ranging, as they do, from a Bell Push to a Super Power Station.

SUN EVERYTHING ELECTRICAL SERVICE.

You must have often wished for some centre where you could adequately meet the demands made by your own Works or Clientèle without the necessity of writing to a hundred-and-one firms for a hundred-and-one items. This is where the Sun Service is useful to you—though (at the present time) it may fall a little short of super power stations and the like; it will always help you out of any difficulties you may encounter in obtaining the materials necessary for the installation of electric light, power, or heat in any class of domestic, industrial, or other building.

For over 20 years the Sun has been at your service in this way, supplying electrical apparatus and plants of all kinds.

Quality has always been the predominant feature, which, coupled with reasonable prices, ensures maximum value to you.

Incidentally, we would mention that you will always be sure of good, honest British or Allied Nations goods. There is "no place in the Sun" for the others.

The Sun is housed in three buildings in London:

118|120, Charing Cross Road, W.C. 2.
In which are located the Offices, Showrooms, and Sales Department.

15, Great St. Andrew Street, W.C. 2.
The General Stores, crammed with reserve stocks of electrical goods of all kinds, but not open for business except through the Head Office.

57|59, Neal Street, Long Acre, W.C. 2.
Works, fully equipped with modern machine tools and plant for producing a large variety of electrical apparatus, Switchgear, etc.

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BIRMINGHAM SALES BRANCH: 50, PARADISE ST
WORKS: 57-59, NEAL ST., W.C. 2
STORES: 15, GT. ST. ANDREWS ST., W.C. 2
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Used on Crane Circuits

for some considerable time under the most disadvantageous conditions — the FLUVENT Switch-Fuse has always demonstrated its utility for Heavy Duty, and given absolute satisfaction.

HOPE'S PATENT.

Fluvent

REGD. TRADE MARK

STANDARD SWITCH-FUSE

illustrated is a modified form of our popular Ajax "S" type Switch, and is built upon mica-insulated steel rods, to Admiralty specification.

It has a parallel break, enabling the blades to leave all the contacts at the same moment; contacts are of phosphor bronze, mounted and well held in strong brass shoes; all moving parts are lock-nutted and split-pinned. The Switches are guaranteed to stand 3000 volts to earth for 5 minutes, and to give an insulation test of 50 megohms.

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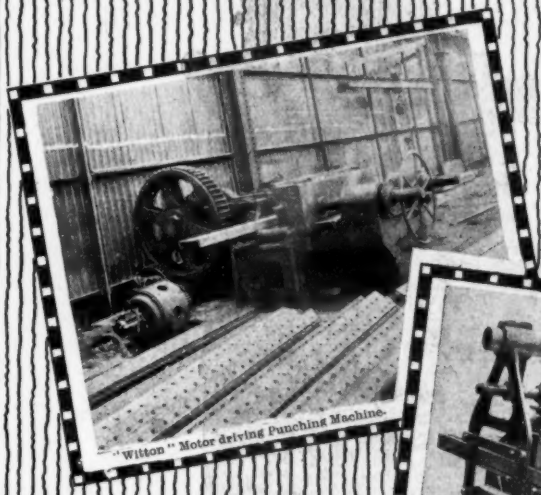
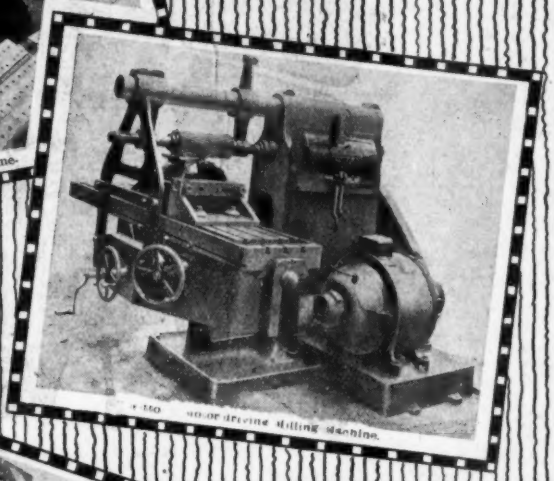
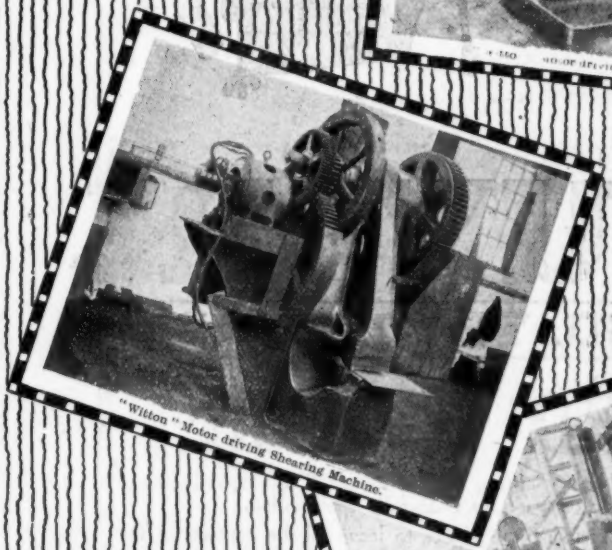
G.E.C.



"Witton" Motor driving Punching Machine.



"Witton" Motor driving Drilling Machine.



"Witton" Motor driving Shearing Machine.

"Witton" Motor driving Portable Drill.

REGISTERED
TRADE MARK

G.E.C.

Industrial Electrification.

No. 18.—ENGINEERING WORKS.

THE electrification of engineering works involves the settlement of a variety of problems which can only be satisfactorily solved by the industrial electrical engineer. Immense sums of money are spent in machine tools, and if those tools do not work to the limit of their output, losses in time and money will occur, which are none the less important because they are unconsciously sustained. **The industrial electrical engineers of The General Electric Co., Ltd., are skilled in the lay out of electrical plant for engineering works.** They will select motors of the most suitable type for operating the machine tools at maximum output, together with satisfactory speed control arrangements with motors of adequate starting torque. **They are also conversant with the special requirements of the wide range of machine tools, and in addition can prescribe suitable lighting arrangements that will ensure the shop being uniformly lighted.**

The experience of the Company's Industrial Electrical Engineers is at the disposal of Engineering works' engineers and managers, and of supply authorities having Engineering works within their supply area, and they are invited to consult the G.E.C. regarding any extensions contemplated either immediately or in the future.

Next Week - - - - AEROPLANE WORKS.

The General Electric Company, Ltd.,

Head Office: Queen Victoria Street, London, E.C. 4.

Telephones: London Wall No. 3600 (32 lines). *Telegrams:* "Electricity Cent., London."

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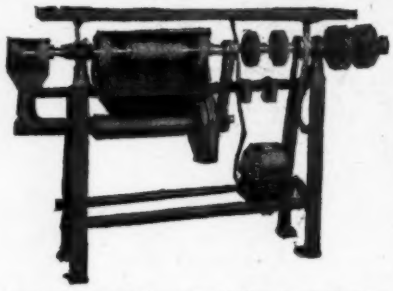
REGISTERED TRADE MARK

Residence lighting service will not be impaired by voltage fluctuation if the small equipments you install are driven by

Century

REPULSION START—INDUCTION

SINGLE-PHASE MOTORS



¾ H.P. Motor mounted on a Small Shoe Repair Machine.

—their starting current is less than three times full load current. We build them as small as 1/10 H.P.

Manufactured only by

CENTURY ELECTRIC COMPANY,

19th Pine to Olive Streets, St. Louis, Mo., U.S.A.

A STOCK OF "CENTURY" MOTORS IS CARRIED IN LONDON BY—

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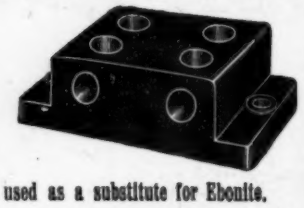

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THE ONLY SUCCESSFUL "TURN-DOWN" ATTACHMENT FOR ELECTRIC LIGHT.

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SUPPLIED IN TWO TYPES: LOW VOLTAGE (80 to 130 V.) and HIGH VOLTAGE (200 to 250 V.).

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RIGHT AT THE FRONT

The **"ADAPTABLE"**
EARTHING AND BONDING CLIP

Absolutely the only clip on the market that will fit any size Conduit, Cable or Pipe.

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Tel. 5635 City. *Or your Supplier.*

The Lamp that makes every ounce tell

Mazda Lamps save coal because they save current.

With Standard Mazda Lamps the current will go *four* times as far as with ordinary carbon lamps, and with Mazda Half-Watt Lamps it will go EIGHT TIMES as far.

Every consumer of electric light can help to save coal by installing Mazda Lamps.

A 30-watt Mazda Lamp used instead of a 40-watt Lamp saves at least an ounce of coal EVERY TWO HOURS.

Never before have Mazda Lamps proved so great a boon as now, when every unit of current counts.

Instal the Lamps which yield most light.

MAZDA
HALF-WATT TYPE
ELECTRIC LAMPS

Good Lighting.

¶ We are Specialists in Good Lighting.

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THE LARGEST MANUFACTURERS OF

PORTABLE ELECTRIC TOOLS

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THE "DUNTLEY" HEAVY DUTY AIR-COOLED ELECTRIC DRILLS & GRINDERS

Represent the Last Word in

PORTABLE DRILLING, REAMING, TUBE EXPANDING & GRINDING TOOLS.

Wound for all Currents and Voltages.

Designed to withstand the heavy overloads incidental to hard and continuous work without damage.

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Capacity:
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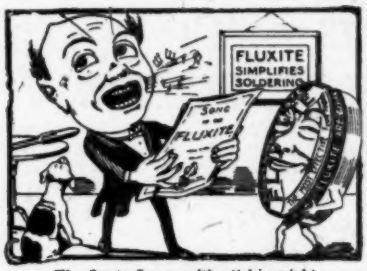
near St. James's Park Station (Dist. Rly.).



The Lusty Lung, with all his might
The praise is sung to friend Fluxite.

Electricians, Plumbers, Gasfitters and other Metal Workers, all sing the Praises of

FLUXITE

as the paste flux that solders even dirty metals without cleaning or corrosion, and joints lead without solder merely by the use of a blow-lamp or blow-pipe. In short, Fluxite

SIMPLIFIES SOLDERING
and Supersedes Lead-Burning.

If desired some solder can be filed into a little Fluxite and the two applied together. Fluxite is a necessity in every tool-kit.

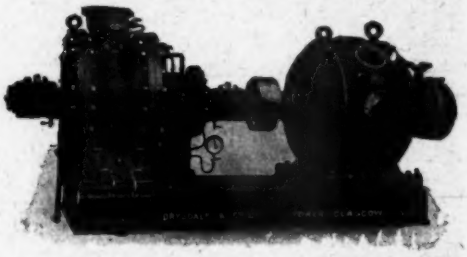
YOU WANT SOME.

Of Ironmongers and Oilshops, in Tins, 8d., 1/4 and 2/8.
Made by THE AUTO-CONTROLLER CO., 34, Vienna Road, Bermondsey, S.E.

BON-ACCORD

CENTRIFUGAL PUMPS

For Coal Washing, Circulating, &c.



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For the Stuffing Boxes of your Pumps and Engines.

TURBINE PUMPS for Mine Pumping and Sinking.

HIGH-SPEED ENGINES
For Dynamos, Fans, Pumps, &c.

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POLYPHASE MOTORS

RUN ON **BALL BEARINGS.**

Smooth Running and Low Running Costs Assured.

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STANDARD SLIP RING INDUCTION MOTOR.

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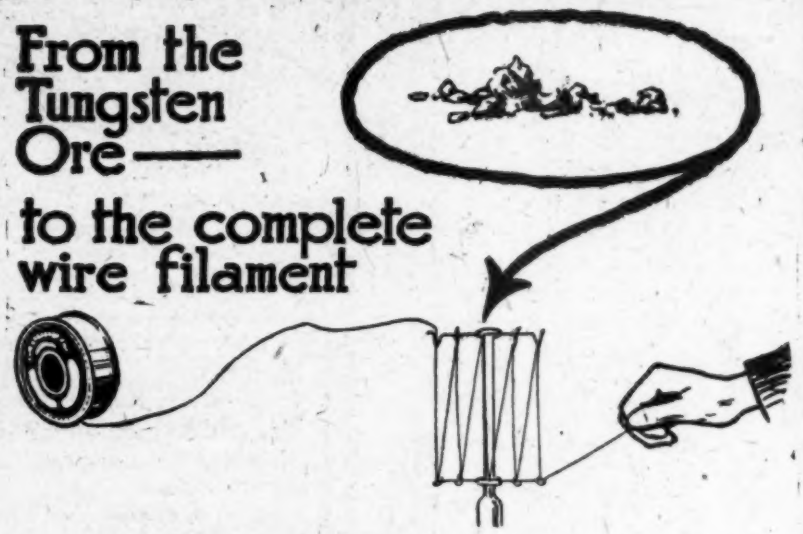
From the Tungsten Ore——



to the complete wire filament

Process by process the work is carried out by British labour in our London Works. We do not buy the Tungsten Powder or the Tungsten Rod.

We begin with the Ore, refine and reduce it, work it into rod, swage it down, and finally draw down into the finest filaments.

We are Tungsten and Molybdenum experts.

See that your lamps are made with

"Pladuram" Wire

which is the only sure guarantee of a British product from start to finish.

Duram Ltd

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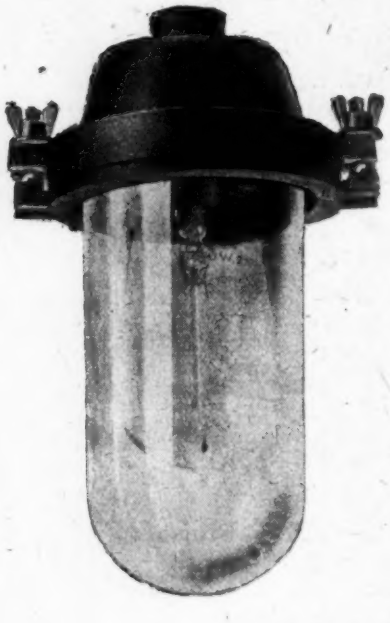
SIMPLEX

Deep Water-Tight Lanterns

Tapped to receive ¾" down drop or bracket arm.



The new pattern illustrated is cast with a deep recess in the top into which the lampholder goes.

The deep cast body and standard well glass make a pleasing well-balanced combination and avoids the necessity of stocking extra deep well glasses.

Write for Mailing Card No. 676.

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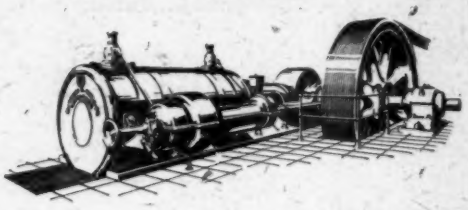

C. M. & M. Central Exhaust Steam Engine.

C. M. & M. CENTRAL EXHAUST STEAM ENGINES, with Piston Drop Valves and Patent Combined Drain, Exhaust and Relief Valve, allowing of exhaust to atmosphere for any length of run.

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WE are now able to give prompt delivery for all types of :—

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ASSEMBLED CORDS & CABLES WITH TERMINAL ENDS.

Our Terminal Assembling Department makes up Cable, Wire and Flexible Leads of every class, with Special Stamped, Turned or Moulded Terminal Ends.

We are manufacturers of all Classes of Insulated Wires, Cables and Terminal End Pieces.

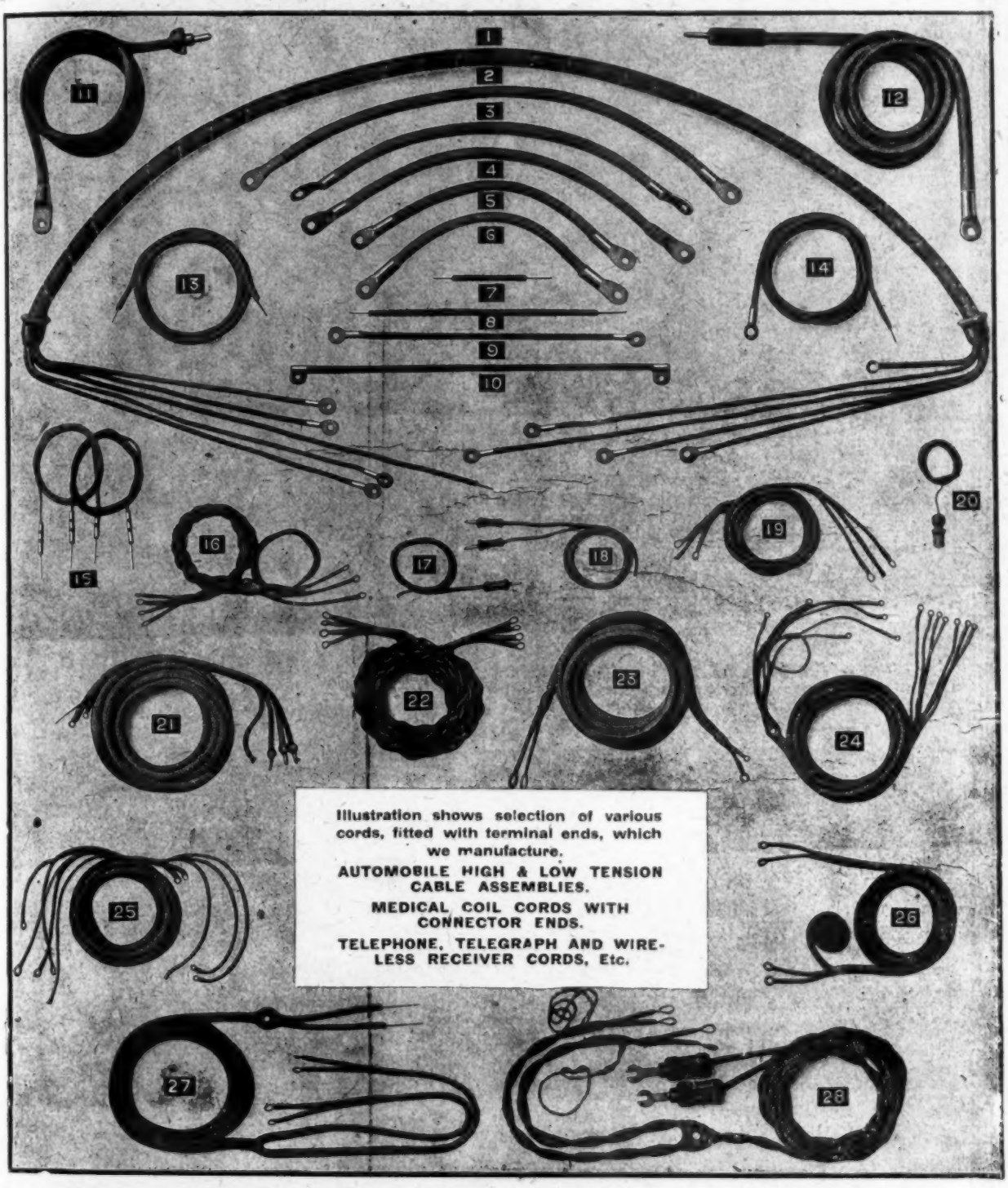

Illustration shows selection of various cords, fitted with terminal ends, which we manufacture.

AUTOMOBILE HIGH & LOW TENSION CABLE ASSEMBLIES.

MEDICAL COIL CORDS WITH CONNECTOR ENDS.

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QUOTATIONS FOR ALL CLASSES OF CORDS WITH TERMINAL ENDS ON APPLICATION.

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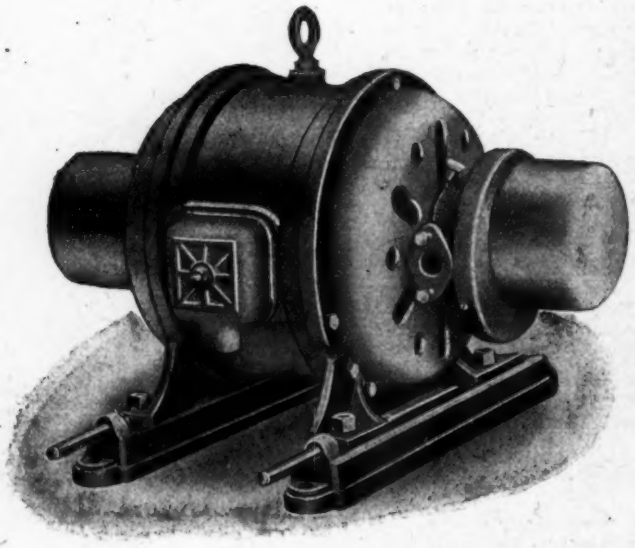
TWO FAMOUS BROOKS

Ye Brooke of Tennyson ~

which goes on and on for ever and hath a world-wide reputation—

and



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of

Huddersfield,

The Makers of the Motors with the world-wide reputation. . .

GILSON'S

have a modern factory with modern plant, and are well equipped in all respects to supply you with high-grade

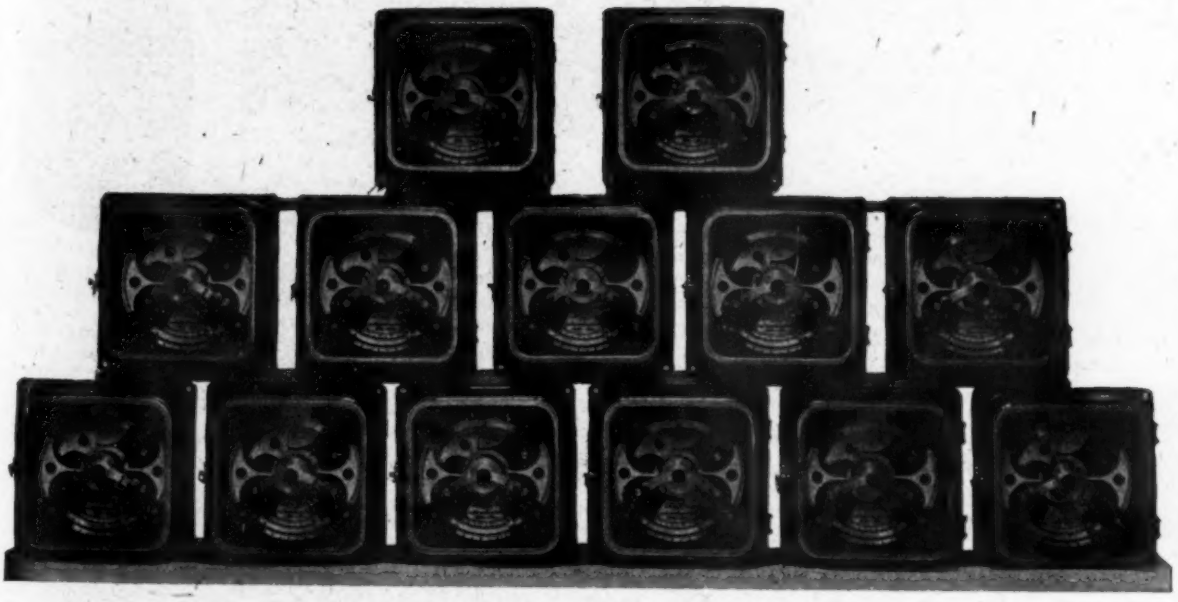
SCREWS

turned from the solid rod.

Please address your inquiries

D. GILSON & CO. LTD., BILLET WORKS, E. 17

AUTOMATIC PRESSURE REGULATORS.



Part of an order for Automatic Pressure Regulator Equipments for the Victorian State Railways.

BROWN, BOVERI & CO., LIMITED, 9, OLD QUEEN ST., WESTMINSTER, S.W. 1

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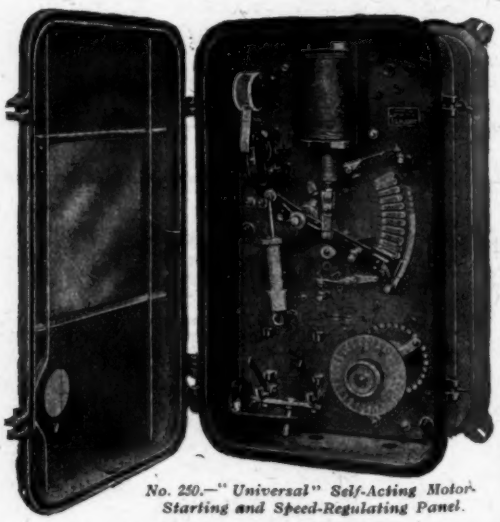
IGRANIC
ELECTRIC
DEVICES

Push-Button Control gets Maximum Output with Minimum Effort.

A foolproof, time-saving equipment for motor-driven **MACHINE TOOLS and PRINTING PRESSES.** Allows unlimited "inching" for setting up or adjusting. Requires no electrical skill from the machinist. Reduces idle time to a minimum. Takes care of the motor and prolongs its working life. Abolishes electrical breakdowns.



No. 250.—"Universal" Self-Acting Motor Starting and Speed-Regulating Panel.

No. 250 type is one of a complete range of Automatic Controllers for all kinds of electrically-driven machines. It is usually applied to machines which have to be started and stopped frequently, but where speed changes are relatively infrequent; so that only a hand-operated speed regulator is provided while starting and stopping is effected by pressing buttons.

No. 450-63. Push-Button Box.

One or more of these Control Stations can be mounted on the machine within easy reach.

In one compact and easily-installed unit is comprised all the apparatus except the push buttons. It is enclosed in an iron box as illustrated and includes:—

MAGNETIC CIRCUIT BREAKER (upper left corner), which has a no-voltage release feature and powerful magnetic blow-out. It protects the starter contacts from flashing, and is the means for "inching."

AUTOMATIC STARTER (centre). — Always accelerates the motor in shortest safe time.

SPEED REGULATOR (lower right corner) can be set before starting up or altered any time. Handle projects through cover. Peephole below handle shows number indicating speed.

MAIN SWITCH (lower left corner) cannot be closed or remain closed with the door opened. It isolates the panel for inspection or cleaning.

IGRANIC ELECTRIC Co LTD

147, Queen Victoria St., LONDON.

50, Wellington Street, GLASGOW.

Works: BEDFORD.

30, Cross Street, MANCHESTER.

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The Industrial Reconstruction Council.—A Conference on Works Committees will be held, under the auspices of this Council, on Tuesday, September 10th, at 6 p.m., in the hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4. The subject will be introduced by Mr. Robert Wilson, of the Ministry of Labour, after which the discussion will be open. No tickets are necessary.

Purification of Coal Gas by Electricity.—The deposition of tar and other impurities from coal gas has recently been undertaken by electric means, and according to the *Elektrotechnische Rundschau* satisfactory results have been attained. High-tension direct current is discharged between a cage made of thin wires and a tube, the system of wires being mounted in the middle of the tube. The gas is cleaned in its passage through the tube. The tendency towards the production of harmful discharges is least if the wire electrode is negative. The shape of the electrode is very important, and the sustaining insulators are specially formed and cemented into the tube. A ½-in. gas tube is passed through a series of cast-iron disks, between which the thin steel wires are fixed. The whole arrangement is then placed in a felt-covered tube, which constitutes the earthed electrode.

The apparatus was tested with a flow of 7,500 cb. m. of gas per hour, two precipitation chambers of 1½ m. height and 0·2 m. diameter being used. The disks of the active electrode were of 100 mm. diameter, and were fitted with 16 thin piano-steel wires. The passage traversed by the gas was about 4 m. long. The gas was exposed to the discharge for about 0·4 second. After five hours' operation the tar deposited on the insulators was found to interfere with the action. For complete cleansing of the gas, 0·2 KW.-hour was required for 7,500 cb. m. of gas. The total cost of the apparatus was about 2,000 marks. The test was made with 20,000 volts and a current of about 3 milliamperes. The temperature of the coal gas has little influence on the operation. Tar deposited at 175° F. is free from water and suitable for asphalting. It can be cleansed in a washing apparatus, and the residue of naphthaline can be won by a second electric precipitation. The illuminating and heating capacity of the gas is improved if the tar is removed hot.

A Flying Hospital.—According to the daily Press, a squadron of surgical aeroplanes is in course of formation in France. Each machine, in addition to the pilot, will carry a surgeon, an X-ray operator, and a complete set of surgical and X-ray apparatus, including a folding aluminium table. Electricity for X-ray and sterilising purposes, &c., will be supplied by a generator on the machine. The intention is to carry succour, quickly and at short notice, to badly wounded men on any part of the battlefield.

The Electrification of Fibres.—In the July issue of the *Journal* of the Leeds University Textile Association is published a detailed account of research work by S. A. Shorter, D.Sc., on "The Electrification of Fibres." The subject is divided into six parts: introduction, textile machines and the electrical series, electricity in carding, electricity in drawing and spinning, electricity in finishing, humidity and electrification. The author points out that the development of electricity by friction seems to be of a very complicated nature, dependent on circumstances difficult to control. The view generally held at the present day is that the so-called frictional electricity is merely a special case of contact electricity, the part played by rubbing being merely the production of effective contact. Lists quoted from different authorities show that the textile substances are in general positive to the substances with which they come into contact. Wool is a worse conductor than cotton, hence it is more liable to electrification than cotton. All the substances which ordinarily come into contact with wool in textile processes electrify it in one way—positively. If in any process some substances electrified it positively and some negatively, the total effect would be much smaller. It is obviously desirable to investigate whether there are any substances which electrify wool negatively. An investigation of this point resulted in the discovery of the following substances which have this property:—Asbestos, vitreous silica, glass (certain kinds), porcelain (certain kinds), buff leather, wash leather, raw hide, gelatine, and parchment. Glass and porcelain were found to be very variable in their nature, and very variable effects were found in different specimens of wood. The discovery of the peculiar property of buff leather (distinguishing it from ordinary tanned leathers) resulted from an investigation of the French drawing machinery. It was found that the wool issuing from the front rollers of a French drawing frame was strongly electrified positively, and that after passing through the rubbing leathers the positive electrification was only slight, in spite of the extra friction. In continuing the account of the research according to the divisions named, Dr. Shorter concludes by observing, with regard to humidification, that it may be pointed out that there is no reason why, with an efficient and efficiently-controlled humidifying plant, the conditions naturally occurring on a "good spinning day" should not be reproduced artificially all the year round.—*Textile Recorder.*

Temporary Increase of Charges for Electric Supply.—Mr. T. W. Cole, secretary of the Provincial Electric Supply Committee of the United Kingdom, writes to draw the attention of the provincial electric supply companies to the new Act (Statutory Undertakings (Temporary Increase of Charges) Act, 1918) referring to the above. Under this Act the Board of Trade is empowered to grant relief to electric supply companies whose financial position has been adversely affected by the war. The relief would be given by authorising an increase in the statutory charges, the relief being limited to sufficient to enable three-quarters of the pre-war rate of dividend to be paid. Applications can now, therefore, be sent to the Board of Trade accordingly.

Flash Suppressors for Railway Generators.—A new device is used in the 3,000-volt sub-stations of the Chicago, Milwaukee and St. Paul Railway, to suppress the cause of flash-over and thus protect the machine when the current output exceeds a pre-determined value.

The device consists of small contactors that short-circuit the armature winding of the continuous-current generator through three collector rings connected in 3-phase relation. The alternating-current short-circuit is applied a few thousandths of a second after the continuous-current short-circuit, and its effect is not only to stop the increase in the continuous current, but actually to reduce its value to practically zero for an instant. The short-circuit on the slip rings reduces the voltage between commutator bars to practically zero, and at the same time a large wattless current is made to flow through the armature, with the result that the net field strength is greatly reduced. The continuous current rises to a sufficient value to flash, but it is damped down by the alternating-current short-circuit before a bar can pass from one brush-arm to the next. The flash which is actually started is suppressed immediately.

The suppressor is actuated and tripped in the same way as a circuit-breaker, except that the suppressor *closes* a circuit instead of having to open one and quench an arc. The contacts have only a short distance to travel and are very small and light. They can be made to close in from 0·006 to 0·008 second.

The continuous-current circuit-breakers benefit from the use of the flash suppressor, because the voltage is reduced to nearly zero before the breaker opens. The flash on the commutator is reduced to a harmless instantaneous "puff."—*Electric Railway Journal*, May 4th, 1918.

Automatic Apparatus to Limit Peak Loads.—The contract under which the Chicago, Milwaukee and St. Paul Railway is supplied with power for the operation of its electrified division is based on a 60 per cent. load factor, with the provision that the load is not to exceed an average value of 12,000 KW. in any five-minute period. Under these conditions it is very desirable to maintain a high load factor, and to this end a scheme has been devised, and special instruments have been developed, which have increased the load factor from 40 to 60 per cent.

The power indicating and limiting system for securing this result consists of a 1,200-volt circuit running from the first to the last sub-station, and fed from a very small motor-generator in the load dispatcher's office. In each sub-station where there is a power-company feed tap there is installed a contact-making wattmeter, which introduces into the power indicating and limiting circuit an additional ohmic resistance whose amount varies with the load supplied at the feeder tap. In each sub-station there is also automatic apparatus which, when the total kilowatts used in the system reach the amount contracted for, and, consequently, when the current in the power indicating and limiting circuit reaches a certain value, causes resistance to be inserted in the fields of the sub-station generators of the motor-generator sets.

This reduces the voltage on the trolley system, causing the speed of all trains to be decreased. The maximum reduction in load thus obtained is about 30 per cent. of that which would be used in case the power indicating and limiting system were not provided. The apparatus is so arranged as to reduce the voltage of the most heavily loaded sub-stations first, and also to reduce the voltage of any individual sub-station, so as to throw the load on the other sub-stations when the load on such sub-station reaches the particular amount for which the apparatus may have been adjusted.

In the dispatcher's office there is a switchboard, on which is mounted apparatus for controlling the small motor-generator set supplying the system, and also indicating and curve-drawing wattmeters, which show for any instant the total kilowatts supplied by the power company.—*Electrical World*, July 20th, 1918.

A New Electric Truck.—With reference to our notice under the above heading on page 199 of our issue of August 30th, we are asked to state that the Chloride Electrical Storage Co., Ltd., do not manufacture electric trucks. Their "Ironclad-Exide" accumulator is, however, used extensively on various makes of trucks.

The King's Fund for the Disabled.—The King has given the magnificent sum of £78,000 to the fund which was recently inaugurated to assist disabled officers and men of the Navy, Army, and Air Force to become useful members of the community again. The trustees of the fund, of whom Mr. John Hodge, Minister of Pensions, is chairman, appeal to the humanity and gratitude of our readers for subscriptions which will help to find a new place in civil life for officers and men of his Majesty's Forces disabled in the war, and for the widows and children of officers and men who have given their lives for us.

The State pension scale must be hard and fast. Outside that scale there is a great human field which the King's Fund can cover, in which the officer, the man, or the dependent can be put on his or her feet, and given a sound re-establishment in civil life.

At present the trustees are receiving 600 applications a week; 2,500 cases have been dealt with thus far. Where the officer or man has been trained by the Ministry of Pensions, or where there is a business given up for war service, which he can restart, an adequate grant can be made.

The fund is a monument of gratitude. It will cheer our gallant fighters to see that monument rising to £3,000,000—the amount aimed at.

Let us, therefore, provide the money—and quickly. Urgent cases are waiting. Contributions should be sent to the King's Fund for the Disabled, Westminster House, Millbank, S.W.1. All cheques and postal orders should be crossed,

Swiss Railway Electrification.—In the June session of the Swiss Parliament, the urgent necessity for railway electrification and for simplification of the management of the Federal railways was again brought up. This time, however, it would seem as if something really were about to be done both in the matter of Federal railway administrative reform and in that of electrification.

The committee which inquired into the electrification question spent ten whole years over preparing its report. A few years ago, electrification would have cost 500,000,000 fr., but now it must cost several hundred millions of francs more—very large sums for Switzerland, especially now. Another estimate of the expense of electrification was between 250,000,000 and 350,000,000 fr. The Swiss Federal Council now proposes to devote 30,000,000 fr. (£1,200,000 on the basis of a normal exchange) annually to the electrification of the State railways. But the prices have quadrupled since the question was first mooted.

Undoubtedly much of the opposition and perhaps even the delay in electrifying the Swiss State railways are to be attributed to the powerful, if invisible, German influences ever at work in Switzerland. Moreover, in normal times German engineers and electricians, their Government always behind them, would have outbid the Swiss. Hence patriotic Swiss, especially French-Swiss, are urging the necessity for proceeding with the electrification of the State railways now, even at the risk of the work being carried out less cheaply than it would be were it done by State-backed German firms. They would rather pay more and have the work done by their own engineers, their own electricians, and their own workmen.

Meanwhile the Scherzligen-Berne line is being already electrified, but it has just been announced that work on the second Simplon Tunnel will probably have to be suspended, as it is no longer possible to procure the necessary materials and labour (chiefly Italian). On the south side 9,314 yards have been completely excavated, and on the north side 9,600 yards. Orders have been given for the building of 20 electric locomotives for the Federal railways. Half are to be built by Brown, Boveri, Ltd., Baden (Switzerland), and half by the Oerlikon machinery works. An electric locomotive at present prices will cost 840,000 fr. (£33,600).—*Railway Gazette.*

Novel Electric Heating System.—A novel electric heating system has been installed at a school in Baden, the arrangements being such as to enable the heat to be stored up during the night, when the generating station is lightly loaded, and to be used for heating purposes in the daytime. The installation utilises the existing hot-water system and radiators. A water-container of about 15,000 litres capacity surrounded with an effective heat insulation is used for heating the water. Inside this container electric resistances are built that raise the temperature of the water to 110 deg. C. during the night. The hot water can be circulated through the system of pipes, its speed being regulated by a valve. The quantity of water in the reservoir is sufficient to keep up the circulation of hot water all day long without switching on the current. Provision against over-heating is afforded by a thermostat. The supply is taken from a 2,000-volt network, and the voltage is transformed down to 220 volts. The total power taken is 100 to 120 KW. The advantage of the system consists in storing heat at a time when the energy is cheap, and thus using a portion of the water-power that is usually run to waste at night time. The system is rather cheaper under the present conditions than one using coal. It is expected that the town will shortly install similar heating arrangements in various other public buildings.—*Elektroindustrie.*

A Submersible Electric Pump.—A valuable adjunct to the Admiralty salvage work is the submersible electric pump, which is now in use on every vessel of the salvage fleet, and it has helped to save many a good ship to which pumps of the ordinary type could have given no assistance, owing to their limited lifting power. The submersible pump is simplicity itself. The special feature of the motor is that it only needs enclosing to keep floating débris from the working parts, while permitting water to circulate through it internally. The motor is of the induction type, with short-circuited squirrel cage rotor, on roller bearings, mounted in gun-metal housings at either end of the set. The only connection required is a three-core electric cable. There are three types of this motor pump in general use by the salvage section—4 in., 6 in., and 8 in. The 8-in. model requires 50 H.P., and will deliver 350 tons per hour at a total head of 75 ft. At a 20 ft. to 30 ft. head the delivery increases to 550 tons. Cooling is effected by a continuous supply of filtered water taken from the delivery. There are no glands to be taken up, or any other details likely to give trouble. The motor, which has its windings insulated by a new process to endure continuous immersion in water, is supplied with current from the salvage ship, or from a special enclosed waterproof portable generator, driven by paraffin engines, which can be placed on board a wreck when cable connection is inconvenient or impossible. These generators, being of the enclosed ventilated type, can be closed up if the weather becomes too bad to continue working the plant, and can then be left on deck until the weather moderates. In most cases the pumps may be suspended from the steamer's derricks and lowered into the water without coupling up any suction pipes. Pumping can begin immediately one length of delivery hose is attached, the whole operation occupying only a few minutes. The advantage claimed for this pump is the fact that it can be brought into action in places that would be inaccessible to the ordinary type. In the case of a large steamer stranded on a rock-bound coast, exposed to the sea and completely waterlogged, the application of ordinary pumping methods would involve the provision of duplicate sets, which would be liable to sustain damage in the event of bad weather approaching. On the other hand, the submersible motor pump could be lowered down to any submerged deck, placed in position by the diver, and driven from the generators of the salvage tug, either alongside or some distance away from the wreck. Should bad weather intervene, it would only be necessary to disconnect the wires, and the pumps, being under water, deep down in the hold, would be practically immune from damage, and could be started up again whenever the weather improved, simply by making a fresh connection. The merits of the new system were seen at their best in the case of a torpedoed vessel which had failed to make shallow water before sinking. Her shelter deck, 57 ft. from the keel, was barely awash at low water, so that the conventional pump would have been useless. Recourse was, therefore, had to the submersible electric motor pump, which was lowered into the stokehold, and, after holes had been blasted in the top of the tunnel to allow the water to drain through into the stokehold and engine-room, the pump got to work, and so lightened the ship that she could be dragged further inshore, and subsequently refloated.—*The Engineer.*

Leads for Electric Furnaces.*—Mr. A. A. Meyer, in a paper read before the American Electro-Chemical Society in May last year, called attention to the serious drop in the voltage between the transformer and the electrodes of electrical furnaces. It was found by oscillograms taken that about 24 per cent. of the available voltage at the transformer was lost as drop in the short copper bars between the transformer and electrodes. According to him, this drop was unquestionably due not to resistance, but to reactance which was introduced in the circuit by the neighbouring steel structure of the furnace. Tests along various sections on these bars showed that the drop per c.m.-ft.† in the bars going through the steel structure, and with a current density of about 1.3 amp. per 1,000 c.m., was over three times that in the flexible leads more remote from the steel work and where the current density was about 1.7 amp. per 1,000 c.m.. The desirability of such large reactance is a question somewhat in dispute. Acting upon these hints, Mr. R. F. Flinterman, of the Michigan Steel Castings Co., Detroit, in a paper recently submitted to the same American society, described the alterations made to a 6-ton Héroult furnace which, in accordance with the old method of construction, had eight solid copper bars ¼ in. by 6 in., 7 ft. long, for each phase, placed triangularly, with 20 in. between phase centres. These bars led from transformers to flexible cables. The latter were about 20 ft. long, consisting of nine 1,000,000 circular mil stranded copper cables for each phase. The cables in turn connected to bars on the furnace itself, the bars being made up of six copper bars ¼ in. by 6 in. in each phase, running first vertically and then horizontally to the electrode clamps. In the case both of the bars between the transformers and the flexible cables, and also the bars on the furnace itself, the ¼-in. by 6-in. copper bars were held apart by 6-in. by 3-in. by ¼-in. copper spacers. These have all been replaced now by vulc.-asbestos spacers. In addition, mica insulation was placed between the various leads in such a way that the different parts were isolated and made to act as nearly as possible independently from one another. It has been found that these small changes have made a great change in the operation of the furnace. From all indications it appears that the drop in voltage found by Mr. Meyer has been much reduced. It was expected that this point would be more clearly established by a series of tests to be undertaken in the near future. Mr. Flinterman thinks it is safe to assume that part of the drop was due after all to skin effect, and that it was not entirely due to induction set up in the steel construction at the rear and top of the furnace. Under the circumstances, he thinks, it would be much better to do away with the solid bar construction entirely. The later Héroult furnaces are now constructed as is the 3-ton furnace of Mr. Flinterman's firm, where the flexible cables are carried direct to the upper part of the steel structure at the back of the furnace. It would seem even better to carry the flexible cables direct through to the electrode clamps. There would be, of course, some induction set up in the steel structure, but there would not be so much voltage drop as there is now. At any rate, as now constructed, the firm's furnaces are running much faster than formerly, and their energy consumption is regularly lower than it was before. On one run of 24 hours 11 heats were taken from the 3-ton furnace. The average energy consumption for the week, including all delays and stops, is running under 625 KW.-hours per ton. Since the work is light, and the metal must be brought to a very high temperature, this is considered a very low consumption.—*Iron and Coal Trades Review.*

* See also ELEC. REV., July 20th, 1917.

† Circular-mil-foot.—A circular mil is a unit used in America and is equal to the area of a circle with a diameter of one-thousandth of an inch.

Electrical Power Engineers' Association.—We are asked to state that the secretary for the Glasgow area is Mr. Arthur H. Kelly, 5, Battlefield Avenue, Langside, Glasgow. The interim secretary for the remaining areas of Scotland is Mr. J. H. Wright, 8, Garland Place, Dundee. All communications on E.P.E.A. business for Scotland should be addressed to the respective gentlemen named above.

Electrical Ship Propulsion.—It is announced that for the propulsion of some of the new U.S.A. steamers recently ordered, the plans contemplate using electrical propelling sets of the type found satisfactory in naval vessels. The men to act as electrical engineers on the vessels will be recruited from big power plants throughout the country.

Appointments Vacant.—Mains assistant, for Croydon Electricity Works, £3 + 20s. + 12½ per cent. bonus; boiler-house superintendent, for Salford Electricity Department. See our advertisement pages to-day.

Electricity as a Soporific.—In a letter to the *British Medical Journal*, Lieut.-Colonel W. F. Somerville, R.A.M.C. (T.), makes the following interesting statement :—

Dr. Guthrie Rankin, in his paper on this subject (broken sleep), says, *inter alia*, "Electricity is said to be sometimes useful as a sedative agent, but its effects are uncertain, and may prove to be exciting rather than soothing." From considerable personal experience I have no hesitation in saying that the reverse is the case. Before mobilisation, nearly four years ago, I treated in Glasgow during the previous 14 years numerous cases of insomnia *per se* by means of high-frequency currents with scarcely a failure, and, when sleeplessness formed one of a group of symptoms in cases of neurasthenia, the good influence of these currents was most marked in restoring sleep. The sleep produced differs materially from that obtained by the use of drugs. It is a refreshing sleep; digestion is not upset, nor is an evil habit acquired. I have never seen any "exciting effects" from the application of high-frequency current, and these should never occur if the treatment is in skilled and qualified hands.

Electrical Installation at a Summer Camp.—A camp 4,000 ft. above sea level where the guests sleep in tents and live out of doors is not the place where one would ordinarily look for extensive applications of electricity. But the proximity of large water-power pointed the way to the wide use of electric appliances at Camp Curry, Yosemite Valley, California, as described in the *Journal of Electricity* of August 1st. Electricity was supplied by the Government power house situated at the head of the valley. This year further provision had to be made to meet the increased load demanded by electric cooking. The cooking load of this camp alone amounts to about 125 KW., plus several motors, a small heating requirement, and the entire lighting load. The peak load occurs at the unusual hour of from 4 to 5 a.m.—the time when the largest amount of baking is being done.

Even in former years, electricity was used throughout the camp, as in the valley itself, for general illumination. The camp is designed for a capacity of one thousand or more, and has been known to register a far larger number. There are some six hundred tents which are arranged in irregular streets. These avenues and the numerous administrative buildings were all electrically lighted. Recently electric heaters have been added as special features for some of the tents for use in the early spring and late autumn. The new cottages which have this year been added to the camp are further provided with electric water heaters, and are electrically lighted throughout.

The important innovations, however, are those of the kitchen department. Here the large oil range has been supplemented by two Hughes electric hotel type ranges of 22 KW. each, making a total of 44 KW. The great advantage in the use of electricity is found in the doing away with the fuel difficulty (neither coal nor gas is available, and the valley is some fifteen miles from a railway), and in the great convenience of heat regulation. The range is started in the morning at full heat to warm it up, and switched later to the medium unit, establishing an even temperature. During the serving period, the low temperature is sufficient and permits the range to be used in part as an auxiliary to the steam serving table. In the same division of the kitchen, an hotel type electric toaster of 3 KW. has been installed. This type has three racks, allowing a large quantity of toast to be made at one time, and has proved one of the great conveniences of the new installation. A 25-KW. Hughes electric bake oven is housed in another division of the kitchen buildings. This takes the place of an old-fashioned brick oven in which wood was used for fuel. The new oven has three compartments into which the large pans fit. These are to be electrically lighted on the interior, permitting inspection of the food while baking. An accurate record of the temperature is shown on the registering thermometers and the heat may be regulated at will. In connection with this department an electric mixer greatly lessens the labour of baking for a thousand or more guests.

Three electric dishwashers of the Peerless type, and a recently installed 9-KW. Hughes hotel type griddle complete the kitchen equipment. With a dining-room which seats over 500, the electric washers have materially decreased the time required for the task, as well as the number of washers needed for dish-washing. The laundry, which is an extensive installation housed in a building of its own, is very completely outfitted, but leaves room for further application of electricity in the future. A great deal of carpentry work is carried on in the construction of new buildings, rustic fencing, and repair work which is continually needed about the camp. This is handled by a small electrically-driven saw mill. These installations and the further additions contemplated were made possible by the construction of the new Government power plant situated some two or three miles below the valley proper.

The new plant has a capacity of 2,000 KW. with a present output of 1,000 KW. A 42-in steel pipe 800 ft. in length carries the water down to the level of the power house, where it is delivered under a 336-ft. head. The pipe is good for 93 sec. ft., but under the present conditions for the generation of only 1,000 KW., only half that amount is utilised. Two 1,250-K.V.A., G.E., 2,300-volt, 30-cycle, 3-phase, A.C. generators of 720 R.P.M. direct connected to a 1,500-H.P. Pelton-Francis turbine, furnish the power. The exciters are 10 KW., 125-volt direct connected. Three transformers, oil cooled, of the outdoor type, 60-cycle, 400 K.V.A., located at the plant, step the pressure up to 11,000 volts, at which it is transmitted over some eight miles to the valley. There it is stepped down to 2,300 volts, which is the ordinary voltage for use. The cost of the entire installation was upwards of $220,000. The installation has given entire satisfaction, and, owing to the reasonable rates for power, which compare very favourably with the cost of wood and fuel oil delivered at the valley, even further extensions are planned for the future.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station Officials.—The Aberdeen T.C. Electricity Committee has increased the salary of the electrical engineer, Mr. BELL, by £100 to £850.

Mr. T. WILSON, mains assistant at the Dover Corporation electricity works, has resigned.

The Manchester Electricity Committee has appointed Mr. S. A. RUSSELL as shift engineer at Stuart Street power station at a salary of £250 per annum, rising to £275 per annum at the end of twelve months; and Mr. C. B. TUTT as shift engineer at the city power stations at £220 per annum, rising to £250 per annum on January 1st, 1919.

Mr. D. B. BREARLEY, works superintendent at the Barrow-in-Furness borough electricity works, has been granted an honorarium of £10 for an improvement effected in the boiler house, through a patent recently granted to the Stirling Boiler Co. and himself.

Mr. A. J. GRIFFIN, engineer-in-charge at the West Ham Corporation power station, has resigned to take up an appointment with the Western Electric Co.

Mr. H. E. MORTIMER, of the Croydon Electricity Department, has been appointed assistant mains engineer in the St. Marylebone electric supply department.

At Burnley electricity works, on Tuesday, Mr. TOM TAYLOR, assistant electrical engineer, was the recipient of a mahogany timepiece as a wedding present.

General.—We understand that Mr. J. C. WHITE has severed his connection with the St. Helens Cable & Rubber Co., Ltd. Mr. White is the designer and patentee of the corrosion-proof system of wiring and fittings, of which particulars have appeared in our pages from time to time.

Mr. A. MANIGHETTI has resigned his position as works manager with the Westinghouse Cooper-Hewitt Co., Ltd., which he has held for nearly five years, to take up an important post with Messrs. J. E. Thompson & Co., Ltd., of Rosebery Avenue, E.C.

Mr. D. G. ROBERTSON, who has been sales manager of Messrs. George Ellison for the past nine and three-quarter years, has now vacated the position, on his appointment as assistant general manager.

Roll of Honour.—The remains of the late Colonel BERTRAM HOPKINSON, C.M.G., F.R.S., who was killed in a flying accident, were interred at Cambridge on August 30th. The funeral took place with military honours. A distinguished company of scientists and others attended the service at King's College Chapel. Among them were: Sir Alfred Hopkinson (uncle), Mr. Charles Hopkinson (uncle), Sir G. Beilby, and Sir Dugald Clerk. The Air Ministry was well represented, and the relatives present included Mrs. Hopkinson (widow), Mrs. John Hopkinson (mother), Mr. and Mrs. Alexander Siemens. The King and Queen sent a letter of sympathy to the widow.

Second Air Mechanic A. J. WINROW, R.A.F., who has been accidentally killed whilst flying in England, was employed

at the works of the British Westinghouse Co., Ltd., Trafford Park.

Lieutenant J. S. Plummer, 5th Leicesters, who has been missing for a long time, is now officially presumed killed on August 16th-17th, 1917. He was last seen well up to the enemy's trenches, badly wounded in the arm, and his C.O. wrote his mother saying that he actually ordered a man who was attempting to carry him back to leave him. The man was very loth to do this, but Lieut. Plummer insisted, saying, "You will take my orders as an officer and leave me." He joined the Surrey Yeomanry in 1914, later transferring to the Leicesters. He will be remembered in electrical circles as a bright and keen business man, and will be missed at the Electro-Harmonic evenings.

It is with great regret that we observe the following notice in the *Times* of August 30th:—

DIED OF WOUNDS.

Byng.—On the 24th August, of wounds, Lieut. Leonard G. Byng, M.C., Grenadier Guards, the second beloved son of the late G. Byng and Mrs. Byng, of 32, Bryanston Square, W., aged 30.

Lieut. Byng was a director of the General Electric Co., Ltd., and many of its subsidiary companies. One of his brothers, Mr. Harry Byng, fell in action in Flanders early in the war, while leading his platoon to attack.

Company-Sergeant-Major R. Edwards, York and Lancaster Regiment, who was in civil life on the Rotherham Corporation tramway staff, has been awarded the Meritorious Service Medal.

Cadet W. G. A. Bird, who was in the electrical department of the North Staffs. Railway Co., has been gazetted Second-Lieutenant in the Royal Air Force, which he entered last February.

Mr. A. R. Green, only son of Mr. W. J. Green, manager of the Weston-super-Mare branch of the Bristol Tramway Co., Ltd., has been gazetted Lieutenant in the Royal Air Force, and attached to the Senior Naval Officers' Base at a station in Eastern waters. Prior to the war he was in the electrical department of the Bristol Tramway Co., and he has served in Egypt for two and a-half years with the Army Service Corps (Motor Transport).

Second-Lieutenant W. G. M'Intyre, Border Regiment, who has died of wounds, was on the staff of Messrs. Babcock and Wilcox, Ltd., of Renfrew.

Lance-Corporal W. Geddes, Scottish Rifles, who has been seriously wounded, was employed at the electricity works, Lossiemouth.

Private D. J. Fry, Machine Gun Corps, and Pioneer W. Daynes, R.E., both formerly in the general office of the India-Rubber Co., Silvertown, have been wounded in France.

Obituary.—Mr. S. A. Mahood.—We regret to record the death, which occurred suddenly of heart disease on August 26th, in London, of Mr. S. A. Mahood, A.M.I.E.E. Mr. Mahood was for many years with the Brush Electrical Engineering Co., Ltd., and later with the Birmingham and Midland Tramways Joint Committee and resident engineer of Smethwick power house. He was 60 years of age, and leaves a widow and one son, who is a lieutenant in the R.E. serving with the British Army in Mesopotamia.

ENEMY PENETRATION AND PROPAGANDA.

In our leading columns to-day we refer to some aspects of the vexed question of German trading influence exercised through neutral countries. In continuation of these comments, it may be remarked that the American Government is "going the whole hog" in its investigation of Teutonic connections in the industrial organisations of other countries. Its presence in the military sense with "both feet" gives it also a very lively interest in the commercial aspects of Teutonic plans for world domination. It possesses a store-house of information which greatly increases the possibilities of successful economic counteraction of enemy influence during the war at any rate, and after the war, too, unless the political developments for future peaceable co-operative activities between a democratised Germany and all the peoples of the earth lead to universal freedom of trade. That is a great ideal, but in the absence of certainty that it is within fair distance of attainment, we can count at the moment upon American investigation of enemy economic interests as of vast assistance to the allies, who are determined that, unless there is a complete change inside Germany, and a change which will last, the economic penetration efforts of Germany shall be fought tooth and nail. American participation in the war makes the task of dealing with Teutonic world-trade connections easier than it would otherwise have been, because Germany had great designs for reviving her industries *viâ* the States. "Negotiated peace" with an undefeated Germany would leave us as a certain legacy incessant warfare in the economic sphere. Absolute military defeat should prevent even that, but whether it does or not we cannot afford in our present plans to omit the making of suitable safeguards. We have referred in our leader to-day to some of the neutral country possibilities against which such safeguards are needed, but, of course, there are many others. What of the elaborate schemes of the Teutonic industrial magnates and financiers who, before America was definitely in the war, were making most insidious preparations for securing a hold on the American Press? What of their plans to secure possession of British papers or neutral ones? What safeguards have the public, other than the Company Acts and the Business Names Registration Acts, for knowing who has an interest in a particular organ? We are not sure that even the Company Acts or the Business Names Registration Acts, with public files at Somerset House and with names printed at office entrances and on notepaper, will suffice to secure our Press against the affectionate approaches of German capitalists who desire gradually and unobtrusively to "work their way in," and so transform opinion and convert the reader to ways of greater sympathy toward Teutonic wares. And those Acts alone may not be sufficient to enable manufacturers to tell whether they are advertising in British-owned and British-hearted publications.

In June the *Times* referred to a new "League for the Promotion of German Economic Interests Abroad." The candid Secretary-General, Herr Peter, of Cologne, admitted that one of its objects was to "obtain a powerful influence over the foreign Press." "He said that all arrangements had been made to begin work immediately after the war, that 11,000,000 marks had already been guaranteed, and that, if the sum can be increased to 100,000,000 marks, 'it will at any rate be possible to secure the publication of German replies in the same quarters in which attacks on German trade interests are published in the enemy Press.'"

Truly, the Press, and especially the Trade Press, while it aims at occupying a position of complete independence from Government and private manufacturing interests, will find it very necessary also to be on the alert against German propaganda enticements and nondescript entanglements from now onwards. Only really strong journals, entirely frank and entirely free from undesirable connections, will be the safeguard of British industry.

In its investigation of German propaganda methods the United States unearthed facts showing that millions of dollars were held at the disposal of advertising firms in New York for promoting German commercial enterprise at the end of the war. One advertising contract was under discussion last year involving an expenditure of £300,000 annually for five years! This was in the belief that unrestricted warfare was going to bring an end to hostilities by June, 1917, but when the United States entered the war the plans and printed matter advertising German products were withdrawn (*Times*, July 30th). Another Prussian miscalculation! America is written off so far as after-war German trade war propaganda is concerned—at any rate, no such plants will find a congenial soil or atmosphere there while American blood is flowing in France. German plans to "nobble" the Press of America were prepared by Dernburg, and by one Viereck, a pro-German editor in the States. Controlling interest in thirty leading papers was to be secured so as to keep America out of the war. Because these schemes failed, it does not follow that they will not be tried again when Germany, in desperate straits, with the mark of Cain upon her forehead, seeks to trade with those she sought to dominate. Already plans to work through the Press of certain neutral countries have been alluded to in these pages, and last week we stated that Swedish electrical manufacturers recognised that the A.E.G. proposals to manufacture in Sweden for the Russian and South American markets were not hopeful auguries for the future. Holland, Denmark, Switzerland, and Spain will all be employed by the German to give a sort of camouflage of respectability to the ill-fame which Prussianism has brought upon Teutonic industry. A writer in a financial magazine has lately drawn attention to the

activity of German industrialists in Spain. They are appointing Spanish agents whose post-war duties will consist in receiving German-made goods, relabelling them "Made in Spain," and so forcing them in markets where otherwise they would hardly be welcome. Such a prospect will not be surprising to our readers, for we have many times referred to German commercial propaganda in Spain during the war. Activity along the same lines is undoubtedly proceeding in other neutral countries, and these circumstances all point to the need for us to see whether there is not something more that we can do to set up a really efficient organisation for ensuring that, even assuming the most utter military defeat of Germany, the way shall not be open for German traders to worm their way into former trade circles under false pretences. The German people will always manufacture for export, but let us do our utmost to prevent them doing business in Allied territories under either an allied or a neutral mask.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Where are we Going To?

Your leader of August 30th concludes:—"When the *Times* urges that Labour should be given anything it pleases to ask for, does it not recognise that it is putting an axe at the very root of the industrial tree?"

Industry pictures itself to my imagination, at the moment, not as a tree but as a runaway coach, with Bolshies on the box, politicians at the pole, and Labour leaders. The employer, from whose hands the Government has taken the reins, still clutches at the brake in the hope of preventing a smash. Why should he not adopt the suggestion of the *Times*, and, in deference to the general wish, let go, to see what happens? So long as Treasury Notes are cheaply reproducible, why should he not join with the majority in demanding a fresh inflation of the currency every few months? Then matters may be more quickly brought to the necessary climax, the resultant wreckage cleared up, and the machine repaired in time for the economic war we are told to expect.

In the same issue, Mr. J. W. Woolley, of the Electrical Trades Union, writes:—"When the E.T.U. has reached the desired goal of solely controlling the industry . . . what is, and what is not, fair output will be decided by the E.T.U."

Reasonable control, with continuity of employment, is essential to successful manufacturing, and Mr. Woolley's remarks are therefore full of promise for our complex and difficult industry. A one-time member of this Union, who for several years watched the progress of our electrical pioneers towards, or through, the bankruptcy courts, may well feel proud of its present capacity, and its aspirations to take entire charge of our future.

No need for us to worry further about restoring our war-wrecked export trade, the training of our future workmen and scientific staff, or the invention of machines or methods to flabbergast the Hun. Mr. Woolley's plan will relieve the dejected employer, whom the Government still holds strictly responsible for the output, of this one remaining burden. Already the employer scarcely counts for strike purposes, as it pays so much better to declare a strike against the State.

Under Mr. Woolley's scheme, good jobs will be found in the great factories of the trusts, or Government departments, for those men whose present goal it is to earn one-half of what they receive. Several men recently left work urgently needed for national defence, on which they were receiving three times the "recognised district rate," and obtained new and better-paid jobs elsewhere; one of them recently wrote home: "We're not expected to work *here*, we just swank around." The trusts can apply their own remedy, by simply doubling prices when it seems necessary to double their output.

When virility returns to Britain, several things may happen. Multitudes of men will be determined to resume their interrupted careers. They will not allow themselves to be handicapped by petty bureaucrats, but will sweep them aside or render them harmless, solacing them, when necessary, by appointing them directors of the British Empire. They will frustrate the knavish attempt by a small faction to introduce the Eastern caste system here under the name of "class consciousness." They will throw down the comparatively recent political division of our free nation into employers and employés, together with its accompanying evil of Government by bribery.

They will start, or restart, hundreds of businesses, and utilise war savings to provide the tools or other forms of capital. To such, and to other existing honest enterprises, the best of our loyal workers will be attracted, and in such they will seek, and find scope, for mental progress and material prosperity. New, and far juster, methods of rewarding human effort will be devised, and will not, as now, depend on the truculence of the individual, or of the combination to which he belongs.

To-day's *Times* reports Miss Simons, at the National Federation of Women Workers, thus:—"The women omnibus workers had brought to the notice of the Government the fact that it was virtually on the edge of a precipice, and that its own making."

The 'bus girls' solemn warning to the heads of the State will remain, even apart from its charming metaphor, one of the precious memories of the Great War. So now to work, and no more for the duration from

Robt. W. Paul.

London, *September 2nd*, 1918.

REVIEWS.

General Lectures on Electrical Engineering. By C. P. Steinmetz, A.M., Ph.D. Pp. 242; 50 figs. London: Hill Publishing Co. Price $2.50.

This work, now in the fifth edition, by the well-known American electrical expert, Dr. C. P. Steinmetz, must not be regarded as a text-book of the ordinary type, but rather as an amplification of a series of lectures.

Thus we find that each subject coming under discussion is not expounded with any considerable attention to detail, but great care has been taken in every case to bring out and lay stress on the fundamental features of the problem.

It is perhaps not necessary to detail precisely the subject matter of each lecture, but, broadly speaking, the book includes considerations of the generation and transmission of electrical energy, the regulation and control of circuits (including an account of such matters as high frequency oscillations and surge and lightning protection), electric traction, and the application of electric power for lighting and chemical purposes.

The conclusions reached by the author are, of course, in accord with American practice, and occasionally interesting differences from the practice in vogue on this side of the water are brought out. One matter of this nature is in connection with the pressures used for low tension lighting distribution, the lamp pressure recommended by the author being 110 volts, as against twice that value commonly used here. The explanation given is that American supply companies are more concerned with the actual light output of the lamp than English companies (whose interest in many cases ceases at the service mains), and that the loss in lamp efficiency at the high voltage is not compensated for by the higher efficiency of distribution.

The section on load factor and the cost of energy is not perhaps so clear as other portions of the book since the writer occasionally speaks of power when the term energy would be of greater service. The chapter on high tension transmission includes particularly useful accounts of corona loss and of the possibility of troubles due to pressure resonance, the relative safety of different types of transformer connections being considered from this point of view.

A very interesting lecture deals with the effect of harmonics in waves, together with a consideration of the methods of avoiding difficulties due to this cause. Troubles due to high-frequency and high-pressure disturbances, whether their origin be internal or external, are well explained, the merits of various forms of lightning arresters being discussed.

Station engineers will find many useful hints in the section dealing with the hunting of synchronous machines, methods of localising the trouble and effecting a cure being considered in more detail than is usual in the book. The regulation and control of circuits is dealt with, but not at great length. We feel that a discussion of the several forms of automatic protection available for generators and feeders would, if made on the lines of the rest of the book, be of great value to engineers.

Electric railway characteristics and motors are dealt with in three very instructive chapters, stress being laid on the value of a consideration of speed-time curves when studying railway problems.

The chapter dealing with the incandescent electric lamp is also of great interest, the fundamental principles being well brought out. In places in this chapter the author refers to the lamp with a tungsten filament as the Mazda lamp; surely it is far better to use the former name, the latter indicating the trade name of the wares of a particular firm.

Taking the book as a whole, we can give it nothing but praise. In a brief review it is only possible to mention a few of the points which are most striking, but in each chapter of the book important truths are brought out in a way seldom seen in works of a more orthodox type. The book may be well commended to all electrical engineers, whatever their standing in the profession, and no one engaged in the transmission or distribution of electrical energy can afford to neglect the perusal of the work. Students taking senior courses in technical schools or universities will also find the book of immense service.

The Lighting Art. By M. Luckiesh. London: Hill Publishing Co. Pp. viii+229; 43 figs. Price 10s. 6d. net.

Amongst so-called illuminating engineers there is a tendency to reduce the consideration of lighting problems to mere formulæ; this viewpoint is fostered very largely by those manufacturers who thrust upon the market devices, some of which are no doubt superior in efficiency and effect to many of the older types of lighting equipment. In the initial stages, while the education of the general public is taking place, this outlook may be laudable, but if pushed to an extreme, the knowledge of the illuminating engineer trained under such conditions is likely to become narrow, and the installations for which he is responsible are merely uninteresting repetitions of previous work, lacking thoroughness, variety, quality, and artistic merit. It may be argued by some that so far as industrial work is concerned, certain of these attributes are not essential, efficiency only being desired, but the author of this book emphasises the important effect the quality of light has upon the worker. It may also be said by some that the illuminating engineer who is a member of the staff of a firm of manufacturers of lighting specialities, will carry out his duties with full regard to the requirements and possibilities of the work in hand. After all, the commercial standpoint will be the main consideration, and one cannot but believe that the result will not be of the best, for the manufacturer is interested in the sale of his own wares, and limitations will be imposed upon the expert. It therefore follows that the specialist who is independent, and who is able to draw from the open market for his apparatus, will in the end produce the installation which is correct from an illuminating engineer's point of view taken in the broadest sense. We are of opinion that this book will assist those whose knowledge, through force of circumstances, may be described as narrow, to obtain a much wider understanding of the subject. The work, which is dedicated to "The relatively small group of men whose unselfish efforts in lighting are directed toward the conservation of vision—that most valuable human resource—and toward the increase in the safety, the efficiency, and the pleasure of mankind through the applications of light—that most potent natural agency," opens with a chapter entitled "The Broad Aspect of Lighting," which in a general way indicates the lines upon which the efforts of the illuminating engineer should run, and closer co-operation with the architect and others intimately interested in the effects to be obtained is advocated. The suggestion is made that as artificial light is more easily controlled, and in many cases cheaper than daylight, as for example, in large cities where space is valuable, a time will arrive when the worker will demand artificial light, and buildings will be constructed in which there is no consideration as to the access of daylight. It may be that the physical health of the worker calls for a certain amount of sunlight; but as there is a tendency towards a much shorter working day, it would appear as if this feature can be obtained to the full during leisure hours. Recent reports by the Welfare Section of the Ministry of Munitions would indicate that from the point of view of prevention of accidents, good artificial lighting is strikingly superior to the average daylight conditions which occur in a factory.

It cannot be denied that the scientific and artistic application of light may be utilised in enhancing the beauties of an object. Existing installations are singularly lacking in this respect, and in the second chapter, it is pointed out that gradation in shading and coloured light have immense possibilities, particularly if the illuminating engineer is trained to foretell the result to be obtained from the equipments utilised, and this "visualisation" is next dealt with. It is pointed out that variety is essential if perpetual interest is desired so that the term "painting with light" expresses the author's aim in a complete manner; this is far from being attained in this country as yet owing to the control which is placed upon most illuminating engineers. The author proceeds to discuss the distribution of light, and many important points, as for instance shadow effects, the influence of the surface illuminated and other allied circumstances which are often neglected, are emphasised. A plea is made for directional similarity between artificial light and daylight, it being pointed out that this procedure obviates the necessity for positional changes in work at the time of change over from one system to the other. Fixture design and salesmanship are next considered, and it is well to note that the commercial standpoint has not been lost sight of in these pages; indeed the shortcomings of the average salesman and salesroom are strikingly dealt with.

The following chapter treats of light and colour in a more technical manner, and contains much that might be memorised by the illuminating engineer with advantage. The colour of various illuminants forms the subject of the next few pages, and practical means are suggested for obtaining tinted illuminants. The pages devoted to "psycho-physiology of colour" form most interesting reading, and those particularly concerned with decorative lighting would do well to bear in mind the remarks regarding colour preference, and the attributes which have been applied to the principal colours. In view of the importance of co-operation between the illuminating engineer and those responsible for the interior decoration and use of a building, it would appear that the simulation of artificial daylight has received a far wider treatment in the United States than in this country, so that students of the following pages will be able to avoid many of the pitfalls, and apply to a particular problem the particular solution required. As is pointed out the spectrum of daylight varies considerably not only during the day, but also from day to day and from season to season, and according to its direction relative to the object illuminated.

Chapter XII deals with special applications of coloured light, and not the least interesting paragraph is that which states that "a battleship which had just been launched was equipped with a lighting circuit of blue lights for use when in an engagement at night or at least when near the enemy. The reason for using blue lights is not clear, but doubtless was for the purpose of obtaining the maximum luminosity with sources of low intensity."

Detailed considerations relating to the design of reflectors are introduced under the heading of simple principles of light control; little that is fresh is here presented, but we do not remember having seen the subject treated in such a clear and concise manner previously. The chapter on lighting and architecture is in our view one of the most important contained in the book, and any attempt to summarise the particulars given would be out of place. Mr. Luckiesh is an authority upon domestic lighting, and the particulars he gives us regarding portable lighting units are unique, as is also his contribution regarding residence lighting. Generally this class of work is carried out in a haphazard way with little regard to the actual necessities, and every person who at any time is concerned with the lighting and decoration of residences should make himself familiar with the arguments put forward. Commercial lighting has formed the subject of separate treatises, but nevertheless the subject is discussed with the freshness which characterises this book throughout. The lighting of public buildings is very carefully dealt with, particular attention being paid to museums and picture galleries. Industrial lighting is treated in a general manner, attention being drawn to the importance of the background, particularly where fine work is to be handled. The public are blamed for their lack of appreciation of the functions of lighting and setting in relation to stage plays, and the possibilities in this connection are briefly touched upon; an especial plea is put forward for the intelligent use of coloured illuminants. When conditions are better there can be but little doubt that spectacular lighting will become of immense importance; the experience gained at the Panama Pacific Exposition will be of considerable assistance to those whose duty it will be to put forward schemes for this type of decoration, and some of the hints advanced by the author suggest the enormous field there is.

Illuminating engineering as generally known in this country is presented in the compass of about a dozen pages. Natural lighting is next discussed, while the book closes with a chapter on the language of colour, which presumably is introductory to a further volume promised from the pen of Mr. Luckiesh.

Seldom have we read a technical work with so much pleasure as the one now before us; it would appear to be one which should be found on the table of all those whose business demands their interest in proper lighting and decoration. It is a book which should become a classical work, and will doubtless be imitated, but it will scarcely be possible for the subject to be presented in a more intelligible and interesting manner.

Interior Wiring. By A. L. Cook. London: Chapman and Hall. Price 9s. 6d. net.

A glance at the table of contents of Mr. Cook's book shows that he has attempted to deal with his subject in a most comprehensive fashion. He might reasonably have confined his work to the actual wiring—quite sufficient in itself for any book—but he has dealt with it from a much wider aspect, covering all the ground that surrounds the subject, including such questions as systems of illumination and types of motors to be used under various conditions. The book is divided into three parts, and only the third really deals with wiring work proper, the other two containing the preliminary data and calculations for power and lighting respectively.

Considering the broad interpretation of his subject that Mr. Cook has adopted, he has covered the ground in very complete fashion, though obviously a book of 400 pages cannot go into great detail in so many matters as are mentioned in the table of contents. The text is clearly and concisely written, and the illustrations, particularly the diagrams of connections, are very good. A series of tables is included which gives a large mass of very valuable data and the book is well indexed.

From the point of view of the English reader, however, there is a very serious defect in that these tables and the various references to wiring regulations are all based on American practice. Tube sizes have a particularly mysterious rating. The sizes are supposed to be inside diameters (instead of outside as over here), but actually a ½-inch tube has an internal diameter of ⅝ inch approximately, and a ¾-inch is nearly ⅞ inch internal diameter, and so on.

Wire sizes, again, are all Brown & Sharpe gauge or in circular mils. Sizes less than No. 14 are not allowed in conduit as compared with our usual minimum of 3/22, and apparently wires up to No. 10 are run solid, *i.e.*, with a single conductor and not stranded—all of which is strange reading

to one accustomed only to I.E.E. rules and a prohibition against any single conductor larger than No. 18.

Many other discrepancies might be noted which would lead anyone into much trouble who followed here the practice indicated by the various tables. Voltage drops up to 5 per cent. for lighting; street lights run "generally in series," and so on, do not agree with our regulations. One curious regulation is mentioned on p. 196, viz., that it is not permissible to run two 120-volt lamps in series on 240 volts.

In part 3 of the book, which deals with the actual wiring installation systems, there are again many divergencies from English practice. Most space is given to screwed conduit, but after that come flexible conduit; armoured cable; metal moulding; knob and tube wiring and open wiring, with a very slight reference to wood moulding (or casing) and concentric systems. Of these open wiring, casing and concentric wiring are the only ones used here, except for occasional special work whilst twin-lead wiring, so largely used here, and also slip tubing, seem non-existent in America. Such wide variations between standard practice here and there are very striking.

In spite of or perhaps because of these defects, from the point of view of the English student, the book will be of considerable interest and value, and if one knows enough to discriminate between what is in accordance with English practice and what is not, much valuable information can be obtained from the book.

NEW COMPANIES REGISTERED.

Bailden Syndicate, Ltd. (151,334).—Private company. Registered August 30th. Capital, £100 in 1s. shares. To acquire, work, develop, and resell any inventions or processes relating to chemical, electrical, or engineering undertakings. Agreement with C. W. Bailey. The subscribers (each with one share) are:—H. S. Denny, 2, Rotherwick Court, Golders Green, N.W., consulting engineer; C. W. Bailey, Evington, Leics., consulting chemist. The first directors are: H. S. Denny and C. W. Bailey. Solicitor: G. Reader, 35, Coleman Street, E.C.

Newcastle Graphite Co., Ltd. (151,285).—Private company. Registered August 28th. Capital, £50,000 in £1 shares. To manufacture and deal in amorphous and graphite electrodes, graphite powder, and other forms of artificial graphite, used in connection with electric furnaces, electrical industries, foundries, the manufacture of blackings, &c. The subscribers (each with one share) are:—H. Peile, Milburn House, Newcastle-on-Tyne, colliery owner; H. Harrison, Elswick Works, Newcastle-on-Tyne, accountant. The first directors are: H. Peile, H. Harrison, F. Priestman, J. E. Davidson, and S. Beeton. Solicitor: W. S. Burton, Pilgrim House, Newcastle-on-Tyne.

Coventry Foremen's Association of Engineering & Allied Trades, Ltd. (151,281).—Registered August 26th. Capital, £4,000 in £1 shares. To promote the mutual acquaintanceship of, and exchange of opinions by, foremen, managers, and departmental heads of the engineering and allied trades of Coventry, to organise lectures, demonstrations, and visits to works and other places, to encourage inventions, to acquaint members with legislation and regulations affecting the management of workshops, to assist members in obtaining employment, to take action in combating foreign competition in connection with the said trades, &c. The subscribers, who are also the first directors, are:—J. H. A. Bagley, 60, Melbourne Road, Coventry, foreman, Coundon N.S.A.A. Factory, 50 shares; W. Greenall, 118, Earlsdon Avenue, Coventry, foreman, H. Williamsons, Ltd., 25 shares; F. C. Meadows, 30, Stanley Road, Earlsdon, Coventry, foreman, Maudsley Motor Co., Ltd., 20 shares; E. L. Roberts, Lismore, Stoke Park, engineer, 50 shares; G. W. Donald, 23, Shaftesbury Road, Earlsdon, Coventry, engineer, 10 shares; G. W. Eastwood, 75, Hugh Road, Coventry, engineer, 50 shares; L. W. Williamson, 60, Thornhill Road, Coventry, engineer, 30 shares. Registered office: 7, The Quadrant, Coventry.

A. W. Richardson & Son, Ltd. (151,301).—Private company. Registered August 28th. Capital, £10,000 in £1 shares. To take over the business of mechanical, electrical, and general engineers carried on by C. W. Richardson, at Skew Bridge Works, Patricroft, near Manchester, as A. W. Richardson & Son. The subscribers (each with one share) are:—C. W. Richardson, Fern Bank House, Patricroft, engineer; W. R. Francis, 50, Victoria Crescent, Eccles, engineer. The first directors are: C. W. Richardson, W. R. Francis, A. Williams, W. W. Mills, and W. H. Liggins. Solicitor: C. J. Booth, Duchy Chambers, 4, Clarence Street, Manchester.

Cremer Aircraft & Industrial Works, Ltd. (151,290).—Private company. Registered August 27th. Capital, £10,250 in 10,000 "A" shares of £1 each, and 5,000 "B" shares of 1s. each. To take over the business carried on by A. J. Cremer, at Lorn Road, Brixton, S.W., and to carry on the business of aircraft manufacturers, engineers, electricians, engine, dynamo, and motor manufacturers, &c. The subscribers (each with one share) are:—A. J. Stryckmans, 21, Coleman Street, E.C.2, member of Brussels Stock Exchange; A. de Barsy, 20, Fortismere Avenue, Muswell Hill, N.10, engineer. Directors: L. Hiard, A. de Barsy, A. J. Stryckmans, and A. J. Cremer (all of Belgian nationality). Registered office: Lorn Road, Brixton, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ramsden Green, Ltd.—Particulars of £500 debentures created July 24th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Reid Bros. (Engineers), Ltd.—Particulars of £6,000 debentures, created August 22nd, 1918, filed, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Monometer Manufacturing Co. (1918), Ltd.—Particulars of £20,000 first mortgage debentures, created July 2nd, 1918, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held in Newcastle-upon-Tyne on August 28th, Dr. J. T. Merz, chairman, presiding. The report for the half-year ended June 30th last stated that the surplus of receipts over expenses was £8,945. After paying debenture interest and preference dividend, 5 per cent., less tax, is paid on the ordinary, £1,000 is put to the credit of reserve for renewals, depreciation, and other contingencies, and £2,600 to the credit of special reserve account, leaving to be carried forward £1,697. The traffic receipts show an increase of £6,154 as compared with the corresponding period of last year. The Chairman said the increase of traffic receipts was a satisfactory feature, although of that increase some £1,400 had been absorbed by higher wages, and the enhanced cost of materials, &c. They had about £2,500 more to deal with this year than last. Last year they paid 2 per cent. for the half-year; now they were proposing to pay 2½ per cent. There were considerable expenses ahead, and, perhaps, there would be a diminished income. There was a claim in respect to excess profits duty which had not been settled yet, and the Government had put forward a proposition for reducing the consumption of electricity with a view to reducing the consumption of coal. This matter was not yet settled; it was not put forward as a definite order, and at present they would take no action. If it were adopted, however, it would mean a considerable reduction of income. Their investments and loans amounted to £34,000, and altogether in reserves they had £38,000. Their traffic was still increasing, but at the same time ther expenses were going up.

Official Announcements re Companies. — The following companies have been struck off the register, and are dissolved:—

Argentine Electrolytic Syndicate.
Armour Plate (Cowper-Coles) Patents.
Bachelet Levitated Railway.
Colonial Rail & Tramway Syndicate.
Crowther & Co.'s Electrical Industries.
Davis Electrical Co.
Electromobile Co.
J. G. Childs & Co.
Mechanical Traction Syndicate.
Miners' Lamp Electric Lighting Co.
Salt Lake and Ogden Gas & Electric Light Co.
Spiral Regulating Dynamo Co.

The following will be struck off within three months unless cause is shown to the contrary:—

A. T. Speedometer Co.
Bleichert's Aerial Transporters.
Feld Bros. & Co., Ltd.
Harold Wood Electrical and Engineering Supplies Co.
Mea Magneto Co.

Lancashire Dynamo & Motor Co., Ltd.—The report for 1917 shows a profit, after providing for interest, income-tax, depreciation and special expenditure, of £26,315, against £29,321, to which has to be added £6,791 brought forward. The present distribution on the ordinary shares is to be 2½ per cent., in the shape of a bonus, making 12½ per cent., free of tax, for the year—the same as for the last two years. It is proposed to place to the reserve £10,000 (equal to 10 per cent. on the ordinary shares), (making £60,000) and to carry forward £7,193. Since the close of the last financial year a fresh issue of shares, of which a substantial portion was taken by the staff, has been made.

Richardsons, Westgarth & Co., Ltd.—After providing for estimated liabilities to the Government, the accounts show a profit of £141,403, plus £46,217 net balance of profit for 1916. It is proposed to pay two years' arrears of preference dividend, and to write large sums off for depreciation, &c.

J. Stone & Co., Ltd.—A dividend of 10 per cent. per annum on the ordinary shares is recommended, £50,000 is put to reserve, and £116,702 is to be carried forward.

Browett, Lindley & Co., Ltd.—Further preference dividend of 3 per cent. on account of arrears. Interim dividend of 4 per cent. on ordinary.

Western Telegraph Co., Ltd.—Dividend 3s. per share and bonus of 4s. per share, making total of 8 per cent. for the year.

Madras Electric Tramways, Ltd.—Interim dividend 8 per cent. per annum, free of tax, on the ordinary shares.

Clyde Valley Electrical Power Co.—2 per cent., less tax (interim). Last year, 1¼ per cent.

Stock Exchange Notices.—Applications have been made to the Committee to appoint special settling days in—

General Electric Co., Ltd.—7,500 additional ordinary shares of £10 each, fully paid (Nos. 50,001 to 57,500).

Oriental Telephone & Electric Co., Ltd.—110,087 additional ordinary shares of £1 each, fully paid (Nos. 179,364 to 289,450).

The undermentioned have been ordered to be quoted in the Official List:—

Callender's Cable & Construction Co., Ltd.—35,000 additional ordinary shares of £5 each, fully-paid (Nos. 30,001 to 40,000 and 45,001 to 70,000).

General Electric Co., Ltd.—7,500 additional ordinary shares of £10 each, fully-paid (Nos. 50,001 to 57,500).

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares.

Northampton Electric Light & Power Co., Ltd.—Interim dividends of 5 per cent. (6d. per share) on the ordinary "A" and "B" and "B" preference shares for the half-year.

Aberdeen Suburban Tramways Co., Ltd.—Net profits for the half-year to July 31st £2,309, plus £1,614 brought forward. Dividend at the rate of 5 per cent. per annum, adding £1,200 to depreciation fund, and carrying forward £1,061.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Interim dividend on the ordinary shares, 2½ per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

THE rapid advance of the Allies and the extremely cheery character of the news from the Western Front go far to keep Stock Exchange markets in good form, and to maintain good prices. The principal feature is the strength of gilt-edged securities. War Loan, Consols, and others of similar character have gone ahead materially, and this has had a natural effect upon other fixed-interest stocks and shares of good calibre. The volume of business is perhaps less than might have been expected. Probably this is something that will be remedied after the holiday season. Meanwhile, prices are buoyant in nearly all departments, with industrials still in the forefront of the activity.

Amongst the latter, considerable animation characterises the Marconi market, and the price of the parent shares has jumped 10s. to 4⅜ under the pressure of strong buying. The subsidiaries are also harder without, however, making much quotable progress, Americans being 30s., Canadians 14s. 6d. The unfavourable effect recently produced by the law-suit in which the American Co. was involved has now completely worn off, and it is stated that the amount of money concerned will turn out to be comparatively small. Marconis have reached a price at which caution counsels profit-taking, although the optimists in the market talk the price higher in the immediate future. Marconi Marines have risen to £3, while the price of Spanish & General Wireless Trust is about 12s. A little business in Oriental Telephone Fractional Certificates has found the price about 13s. Monte Video Telephones are 2s. 6d. better at 25s., and Cuba Telephones have risen to 10¼.

The rise in Districts continues to make uninterrupted progress, and this week the stock has advanced to 25½, which is only a point below the quotation for Metropolitan Consolidated. In this market, the cheerful optimist is also apparent, and, although the possibility of an early dividend is ridiculed, some stick to the opinion that shortly after the war the company will be in a position to make a distribution to its proprietors. Underground Electrics are steady, though the market is less buoyant than it was a fortnight ago. Business has been done in the contingent certificates of the company, these being quoted on the basis of 1s. 3d.–1s. 6d. The Income Bonds of the company are ex £2 net dividend, and at 84 show a rise of 10s. on balance.

There is nothing fresh to report in the list of home electricity companies. Two or three shares are quoted ex dividend, and this accounts for the only movements. More business is afoot in manufacturing shares, although here, as we were noticing a week ago, business has fallen off to a considerable extent compared with what it was in the early part of August. Ediswan shares are now quoted in their new denomination of £1, and the present quotation of 16s. 3d. is roughly equivalent to that which prevailed before. Electric Constructions hold their rise to 27s. 6d. Henley Ordinary are ex 6d. dividend, and the Preference are ex 2s. 3d.; no change has been made in the price of either. Cromptons are changing hands about 16s. 3d., and the Preference around 19s. 6d. Victoria Falls Ordinary are 18s., and the Preference 23s. 3d. British Insulated Ordinary are another ½ to the good at 45s., and British Aluminium rose to 40s. 7½d. Buying from the North raised Babcocks to £4, and other shares connected with the iron, steel, and coal industries are prominently good. Telegraph Constructions gained 30s. at 47, and nearly all the shares in the manufacturing list, whether electric or telegraph, remain a very hard market.

Amongst the foreign and colonial issues, British Columbia Electrics have weakened in spite of the cheerful advices received from Vancouver with reference to the conditions of business in the city and the province. Mexicans are mostly higher, and Mexican Light & Power First Bonds at 57 are 2½ points up, the Common shares at 29 gaining 2. Brazil Tractions hold their recovery, and Anglo-Argentine Trams are as a rule more easy to sell than they are to buy.

The rubber share market has got on to rather firmer ground, and the slump has been stayed by the incursion into the market of a good many bargain-hunters. Nevertheless, the immediate prospect is obscure, although for after-the-war dividends the outlook is bright enough. Not a great deal is being done in the market for base-metal shares. Amongst armaments, Vickers stand out with a big rise, induced by reports circulated in the market to the effect that when the companies' accounts do appear, the figures will show wonderful results. Armstrongs have appreciated in sympathy.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Sept. 3, 1918.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Bromton Ordinary	9	10	6¼	—	£7 17 0
Charing Cross Ordinary	5	4	3¾	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11½	—	6 19 2
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
County of London	7	7	10½	—	6 17 7
do. do. 6 per cent. Pref.	6	6	9½	—	6 1 6
Kensington Ordinary	6	7	8½	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼xd	—	7 18 10
Metropolitan	3	4	3¾	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6¾	—	7 1 2
South London	5	5	8	—	6 12 4
South Metropolitan Pref.	7	7	20/6xd	—	6 16 7
Westminster Ordinary	7	9	8½	—	7 13 3
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	97½	—	£6 3 0
do. Def.	1½	1½	23½	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10¼	+ ¼	*6 16 7
Eastern Extension	8	8	12½	—	*5 8 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10¾	+ ¼	5 15 8
Great Northern Tel.	24	22	37½	—	5 17 4
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4⅜	+ ⅛	4 11 6
Oriental Telephone Ord.	10	10	8½	—	3 4 0
United R. Plate Tel.	8	8	7½	+ ⅛	*5 4 1
West India and Panama	6d.	1/3	1⅞	— ⅛	*3 12 0
Western Telegraph	8	8	16⅝	— ⅛	*4 17 9
HOME RAILS.					
Central London Ord. Assented	4	4	60½xd	—	6 12 3
Metropolitan	1	1	26½	— ½	3 15 6
do. District	Nil	Nil	25½	+1½	Nil
Underground Electric Ordinary	Nil	Nil	9⅝	—	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	6	4	84xd	+ ½	*4 15 3
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½xd	—	£6 9 9
Anglo-Arg. Trams. First Pref.	5½	5½	3½	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	66	—	7 12 9
Brazil Tractions	—	—	46	—	—
Bombay Electric Pref.	6	6	102	—	£5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60½	—	8 5 4
do. do. Preferred	Nil	Nil	43	—1	Nil
do. do. Deferred	Nil	Nil	38	—1½	Nil
do. do. Deb.	4½	4½	60½	—	£7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	30	—	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	29	+2	Nil
do. Pref.	Nil	Nil	41½	—	Nil
do. 1st Bonds	Nil	Nil	57	+2½	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	4	+ ¼	£3 15 0
British Aluminium Ord.	10	10	2⅛	+ 7/8	4 18 6
British Insulated Ord.	20	20	2¼	+ ⅛	4 9 0
British Westinghouse Pref.	7½	7½	2½	—	5 9 1
Callenders	20	25	11½	—	£4 4 6
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	22	20	3⅜	—	£5 10 4
Edison-Swan, "A"	—	—	[illegible]	—	Nil
do. do. 4 per cent. Deb.	4	4	75	—	£5 6 0
Electric Construction	7½	10	1¼	—	£7 5 6
Gen. Elec. Pref.	6	6	10½	—	£6 5 4
do. Ord.	10	10	18½	—	*£5 8 1
Henley	25	25	2½xd	+6d.	£5 16 0
do. 4½ Pref.	4½	4½	4xd	+ ½	£6 12 6
India-Rubber	10	10	17⅛	—	*£5 16 9
Telegraph Con.	20	20	47	+30/-	*£5 2 0

*Dividends paid free of Income Tax.

TURBINE HOUSE PLANT OPERATION.

By T. G. OTLEY, M.I.E.E., and V. PICKLES, A.M.I.E.E.

(*Abstract of paper read before the* South African Institute of Electrical Engineers, *May*, 1918.)

(*Concluded from page* 214.)

In the operation of condensing auxiliaries care should always be taken to get the best possible service out of the plant, it should at all times be run at as high a speed as practicable. There is another point, however, which has an indirect bearing on the operation of this plant and that is the aeration of feed water. Condensed water is almost ideal for boiler purposes, but the volume of air which it contains has to be carefully considered, especially when rotary air pumps or kinetic ejectors are used. With the exception of the air pumps supplied with the eight 3,000-kw. sets installed at Simmer Pan and Brakpan and the two provided for the 12,000-kw. machines at Brakpan, all our air pumps are of the rotary type. The air pumps for the 12,000-kw. sets at Brakpan are of the kinetic type, supplied by Messrs. Allens, of Bedford. The Rosherville 9,600-kw. turbine auxiliaries consist of a small Curtis turbine, driving twin circulating pumps, condensed water, and "Schleuder" air pump. The condensed water and the Schleuder impellers are in one casing with a diaphragm between, both taking their suction from a common pipe with a weir fixed across. It has been found that the condensed water impeller at normal speed of revolution is capable of handling a much larger volume of water than the normal quantity passing through the condenser, and consequently the water is churned up and a quantity of air is drawn over from the Schleuder side, with the result that the water passing up to the hotwells is almost saturated with dissolved air. This type of air pump was first installed by us at Rosherville, and shortly after the station started up we experienced serious corrosion in the economisers and boilers. The trouble was traced in a large measure to the amount of air contained in the condensed water. The remedy was to place an artificial head on the discharge side of the water pump whereby the impeller was kept flooded. Since that time corrosion arising from air-saturated water has practically ceased. Speed regulation is effected by means of throttle governor, but to compensate for large differences in the exhaust pressure, hand controlled nozzles are provided. Beyond providing a small collar at the side of the air pump end bearing, there was nothing to take any end thrust, and we have had to design and install a ball end thrust bearing fitted to the bend supplying the water to the air pump. The pumps have on the whole proved themselves extremely reliable and cheap to maintain.

At Brakpan with the kinetic type of auxiliary, air is extracted from the condenser by means of an ejector using water as the entraining medium. The ejector water is drawn from a tank into which the condensate is discharged, which arrangement is ideal for aerating the water, resulting in serious corrosion taking place in the economisers. A rearrangement was made whereby the condensate instead of being discharged into the tank was pumped direct to the hotwell, and the tank was used exclusively for the kinetic ejector circulating water. The temperature of this water was kept low by allowing it to overflow into the dam and making up with cold water. This matter of the aeration of boiler feed water is of very great importance, and it has not received the attention or consideration which it merits.

It may be of interest to give a comparison of the performance of these sets with the type in use at the other stations. The comparison is made with one of the 11,000-kw. sets at Simmer Pan, the main turbine and the main condensers being exactly similar and in the same state of cleanliness.

—	Load kw.	T1 deg. C.	T2 deg. C.	Tv deg. C.	Tc deg. C.	Tv-Tc.	Condenser Coefficient.
Simmer Pan No. 7...	9,800	15·8	24·2	36·1	25·6	10·5	98·1
Brakpan No. 4...	10,000	18·7	30·2	34·8	32·8	2·0	96·0

The kinetic pump shows a clear gain in the matter of vacuum, which is all-important, and its air removing capacity is shown by the small difference between Tv and Tc which is a direct gain to the boiler house, and is well worth having in a station running at a high load factor.

Some three or four years ago we went very closely into the performance of our condensers, and a number of experiments were made by the research department under the direction of Mr. G. M. Clark, to find whether the efficiency of the plant supplied could be improved. The first experiment was to ascertain whether the quantity of air leaking into the system and being dealt with by the air pump was excessive. Known quantities of air were admitted to the condenser, and the effect on the vacuum noted. By plotting weight of air admitted against volume of air pumped out, it is possible by extrapolation to determine the quantity of unmeasured air entering the condenser. In the case of the condenser of one of the 9,600-kw. sets at Rosherville, it was found that .04 lb. of air per second passed through the condenser in the ordinary way with the steam. By calculation this gave a volume of approximately 1,000 cu. ft. of air and vapour being dealt with by the air pump per minute. It was also calculated that the vacuum could be improved by about 3 per cent. if the air pump capacity were increased by 50 per cent. or if the normal volume of air passing through the condenser with the steam were reduced by one-half, that is to say, .02 lb. per second. We have not, however, succeeded in effecting such a reduction, and it would appear that the figure given, namely, .04 lb. per second, is the normal for condensers of this size.

The experiments proved the importance of the factors mentioned, but once a plant of this kind has left the factory it is too late to effect improvement by making alterations in design or construction.

All our feed pumps are steam driven. With the exception of four Clarke, Chapman reciprocating pumps at Simmer Pan, they are all of the steam turbine centrifugal type. Sixteen were supplied by the A.E.G., Berlin, and three, the latest installed, by Messrs. Weir, of Cathcart. These three pumps are the best on the system, they have been running for nearly four years, and have cost practically nothing to maintain. The steam from all feed pumps can be exhausted either to atmosphere or into the hot wells or feed tanks. The exhaust pipes from the hot wells terminate in a nozzle ejector, correctly shaped so as to avoid water hammer. As originally designed, the steam was first passed through a coil immersed in the hot well. This resulted in excessive back pressure, which materially restricted the capacity of the pumps, and the coils were therefore cut out. Except in the hottest weather, when the vacuum temperature and condensate temperature are high, we recover practically all the heat in the exhaust steam.

It is only rarely that we have been unable to utilise the whole of the heat energy in the feed pump exhausts, but some 18 months ago when the river temperature at Vereeniging rose to 36 deg. C., three-quarters or more of the heat in the feed pump exhaust was sent to atmosphere, the difference between the condensate and the feed temperature being only about 2.7 deg. C. This condition of affairs was principally due to the fact that there was only about five or six feet head at the feed pump suctions, and this illustrates the importance of considering this point in power station design. The hot well should always be placed at such a height that the feed pumps will keep their suction whatever the temperature of the feed water may be. All steam traps discharge into the hot well. The quantity of heat recovered in this way is indeterminate, but there is no doubt that the expense of carrying the drains to the hot wells is amply repaid in the saving of the heat effected. On the total quantity of water evaporated at all our stations, a 1 deg. C. gain in feed-water temperature is worth about £50 a month to the company.

The Power Company is a very large consumer of its own power. About 4.7 per cent. of the electric units generated at our different stations are absorbed in electrically driven auxiliary machinery, draught fans, service pumps, mechanical stokers, and other sundry auxiliary plant. Expressed in kilowatt hours this means that the electrically driven auxiliaries in the power stations use over 36,000,000 units per annum. This is incidental to an annual output of electricity and air of 840,000,000 kw.-hours. Even at 100 per cent. load factor this is equivalent to a load of 4,150 kw., which is a somewhat striking figure, and leads one to the conclusion that the efficiency of auxiliary plant should receive very careful consideration. It should also be borne in mind that the greater part of our auxiliary plant is steam driven, all the circulating water and air pumps for the large machines being turbine driven. If these were electrically driven the units used on the works would indeed become a really formidable total.

Efficiency in the operation of any station can only be obtained by close supervision. In commercial operation, although the same supervision cannot be exercised as in a test, the operating data returned should be sufficient and accurate enough to form a reliable opinion of the performance of the plant. The most difficult thing to measure is the quantity of steam used in the turbines. None of the ordinary forms of water meter we have tried gave us sufficiently accurate or consistent figures. The arrangement until recently in use at all our stations consisted of an orifice inserted in some convenient place in the condensate pipe, and the difference in the pressure on the up and down stream sides of the orifice was measured by means of a mercury manometer, a simple U tube. The quantity of water flowing through the orifice varies as the square root of this pressure difference. A scale fixed to the manometer gave us the rate of flow at any instant in lb./hour.

In commercial work, with readings taken every half-hour by the turbine driver and not a skilled observer, the results obtained were not as accurate as we would have liked, and we have therefore discarded this method of water measurement, and for the time being all the water figures are estimated.

The problem of increasing efficiencies is two-fold. First, how to use coal to the fullest advantage, both with regard to

extracting the maximum amount of heat energy from it and also the recovery of the innumerable by-products which it contains. Second, how to use to the fullest extent the heat available when coal is used either directly or indirectly for generating steam in boilers. This problem is one of the very greatest importance from the economic and national point of view, especially in England. It is not of such great importance in South Africa as it is in industrial countries, such as Great Britain and the U.S.A. In South Africa coal is relatively cheap and the consumption is relatively low.

Steam power engineers, especially in England and America, have been investigating the problem principally from the point of view of increasing turbine-house efficiencies, quite apart from any possible increase in boiler-house efficiency, or the recovery of by-products. As a matter of fact, there is probably greater scope for economies in the boiler houses of the world than in turbine and engine houses; yet if we leave out the question of by-products, there is not the same margin for economies in a well-conducted boiler house as there is in the turbine house.

With the present design of plant annual boiler-house efficiencies of 76 per cent. and 80 per cent. are not unknown, but we should be very much surprised to hear of a turbine house returning an average annual efficiency of 20 per cent. per unit sent out. The chief reason for this is that turbine machines to-day work on such a small range of available energy, that although the turbine itself may be a relatively efficient machine, not more than 20 per cent. to 22 per cent. of the total energy is utilised even under the most favourable conditions. Until some genius arises who will show the way to recover the energy at present lost in the circulating water and which to-day, even in well-operated power stations, represents 60-70 per cent. of the total energy in the coal, the most promising direction in which to increase the available energy is by increasing both steam pressure and temperature.

With regard to the improvement in steam efficiency brought about by the use of higher pressures, it appears to us that increases in pressure should be balanced by increases in temperature, otherwise it is difficult to see that turbine efficiency will even remain as high as it is at present, unless some scheme of reheating between stages is adopted. This is because an increase in pressure alone will result in a lower dryness fraction at the low pressure end of the turbine. On this account, and at the risk of laying ourselves open to the charge of being conservative, we express the view that progress will best be served by increasing pressures, not at one bound to 500 or 600 lb. per sq. in., but by gradual stages, as although the theoretical gains which can be shown are very substantial, it is not at all certain that they can be realised in practice.

Considering the matter in all its bearings, we are of opinion that a considerable proportion of the gain in efficiency will also be neutralised by increased maintenance and capital cost.

In times of stress like the present the Government calls to its aid the entire engineering strength of the country. There is no stinting of public money for experimental work in connection with the war, and it is now realised that the work of the engineer is one of the principal factors in the war. Unfortunately, this view is only taken when it is too late to be of the greatest use. National greatness and strength in war are more dependent on the energies of a people in peace time, and we submit, as is the case to-day, so in normal times it is the engineer, using this term in its broadest sense, who plays the principal part in national greatness. This leads us to the conclusion that while to one man or to one firm of manufacturers, the decision as to whether he will risk his reputation or their financial position in a radical change in engineering practice, is a very great undertaking, to a Government such a burden is a light one. We submit, therefore, that pioneer work of this description, when endorsed by a representative institution or committee, should be cheerfully undertaken by the Government as a national obligation.

THE APPLICATION OF ELECTRIC WELDING TO SHIP CONSTRUCTION AND REPAIR.

We have received from Capt. JAMES CALDWELL, R.E., of the Welding and Labour-Saving Division of the Admiralty Labour Department, who has recently been investigating the above-named subject in this country and the United States, the following information:—

The systems of electric welding which are now being employed to a limited extent, with every prospect of considerable further application in the fabrication of ships, are:—

1. Resistance welding, comprising butt, spot, and line methods.

2. Arc welding, employing either bare or flux-covered metal electrodes.

Butt welding is suitable for the joining of bars which constitute the longitudinal members of a concrete ship, but the service applications in a shipyard are limited.

Spot welding has been largely used to unite sheets or thin plate where a continuous weld or joint is not required. The two sheets are placed between electrode clamps which press them together; current is then switched on, and the surfaces in contact are brought up to a welding heat. The pressure is maintained after current is off until sufficient cooling occurs. The sheets are then moved on to the next spot to be welded, and the operation is repeated. Work so welded is therefore united by a line of small welds or spots, and may be compared to flush riveted work.

Further developments of this method, which comprise the riveting of much thicker plates as required for the hull of a ship, have been applied in America recently. It would appear that spot welding is eminently suited to replace riveting and caulking to a very large extent in the future.

Line welding is somewhat similar to spot welding, with a continuous line jointure which is obtained by passing the steel between roller electrodes.

Whereas arc welding with bare metal electrodes has until quite recently been almost exclusively used in America, the flux-covered metal electrode has had most extensive use in Britain.

(*a*) With the bare metal electrode system of arc welding an arc is struck between a rod of metal and the work. The heat then generated at this point melts a small pool on the parts to be welded, and additional metal is deposited from the electrode in a molten state, thereby forming a firm union between the new and the old metal, if certain precautions are adopted to ensure even application and the prevention of porous metal due to excess of current.

To prevent oxidisation the metal rod is sometimes coated with a sleeve of insulating material which decomposes with the heat, and surrounds the molten metal with an inert gas.

(*b*) The flux-covered electrode system of arc welding most commonly used in this country provides for the metal electrodes being encased in a flux composition which becomes molten at the arc so that the added metal is at no time exposed to oxidisation. When properly applied, this flux forms a silicate slag of suitable viscosity which floats on the metal surface until removed, when cold by tapping with a small hammer and using a wire hand brush. Arc welding, whether carried out with bare or flux-covered electrodes, has a wide application to ship construction and repair.

For carrying out spot welding alternating current is necessary. The supply voltage is immaterial, as a transformer forms part of each machine. With spot welding it was formerly understood that the metal adjoining the weld became very brittle when subjected to vibratory stresses, the line of juncture between plates containing a layer of oxide, which considerably weakened the weld, and difficulty was experienced in obtaining sufficient adhesion. However, with recently developed machines provided with gear to give sufficient pressure to close the plates, and by the use of increased current, the latter difficulties have been overcome, whereas crystallisation does not occur to any appreciable extent with thick plate work.

A spot-welding machine suitable for thick plates is a heavy tool weighing several tons, and is therefore most efficiently employed as a stationary plant. It is therefore recommended that in the first instance spot welders be confined to the fabrication of internal ship parts. Spot welding work may be made more or less watertight by reducing the spacing of the spots even to the extent of making adjacent welds overlap. When spot-welding bulkhead plates and framing, it is advisable for this reason to weld alternate spots in one operation, then transversing the work again to complete. Unfortunately at the present time spot welding cannot be applied extensively in this country owing to the impossibility of obtaining the necessary machines and suitable electrical apparatus.

No sweeping decision can be made as to the relative merits of arc welding by means of bare-metal and flux-covered metal electrodes. There are certain conditions that seem to preclude the universal adoption of any one of these methods.

Both bare and flux-covered metal electrodes are effective with direct-current supply, provided the voltage and current at the arc are kept within the desired range. To obtain reduction in the line voltage, a motor-generator or rotary balancer must be employed.

Bare-metal electrodes are not now suitable for use with alternating current, although there are certain investigations afoot, such as the "Holslag" transformer, that would seem to make it possible to use bare electrodes with A.C. supply. The results obtained with flux-covered electrodes are, however, quite satisfactory, and particularly good penetration is secured with certain types of electrodes. With the latter the supply may be taken direct to the arc through a "Holslag" transformer, or 110 volts may be obtained with a static transformer, the current regulation at the arc being maintained by a regulating resistance in series.

As regards the respective merits of bare and flux-covered metal electrodes for arc welding, apart from electric supply conditions, there is no reason why a correct weld by either method should not be made to approach the tensile strength of the original plate.

By virtue of the annealing properties of the slag and the absence of oxidisation in added metal, the flux-covered electrode is superior in respect of the ductility of the weld.

The flux may be made the vehicle of constituents which will give desired characteristics to the added metal. Porosity or piping will also be reduced by the use of flux-covered electrodes.

The bare-metal electrode is the cheaper if connected direct to the general electric supply system. It is, however, more usual practice in America to provide an auxiliary machine with substitutional resistance or other regulating features to

give the correct current at the arc, whereas with flux-covered electrodes no such refinement is necessary.

The power required and the cost of the equipment vary with the number of welders in use, the character of the work, and the method employed. The larger the number of welders in simultaneous use the more closely the total power needed will approximate to the sum of the averages, so that installations providing for many welders are relatively less costly in regard to power plant than small installations, with only a few welders.

Comparing welding with riveting by eliminating the routine of marking and punching, reamering, and caulking, to say nothing of the planed butt straps and insertions at watertight joints, there is ample margin to cover the cost of similar construction by means of electric welding until the process is standardised, when costs would be further reduced.

The most important point in favour of extending the use of electric welding is the reduction in the amount of labour as compared with the present charge under this head, which is:—

1. Twenty-five per cent. for barge, tank, and deck structure.
2. Fifty per cent. for smith work.
3. Seventy-five per cent. for selected details.

Furthermore, superfluous material in the form of overlapping riveted plates and of angles and brackets would be considerably reduced.

THE "D.K. 30" VENTILATED TRAMWAY MOTOR.

The conditions under which tramway motors operate are well known to be the reverse of ideal. Many of the difficulties associated with the design and operation of tramway motors would be obviated if a really satisfactory system of ventilation could be provided, and with this object in view Messrs. Dick, Kerr & Co., Ltd., have recently placed on the market a positively ventilated type of traction motor, which will strongly appeal to those engineers who favour the ventilated type of motor.

This machine, known as the "D.K. 30," is of the interpole type, and in general design follows the firm's standard practice. It is, however, supplied with either split frame (as illustrated) or box frame, which latter construction is now finding favour particularly abroad; the frame itself is of high-

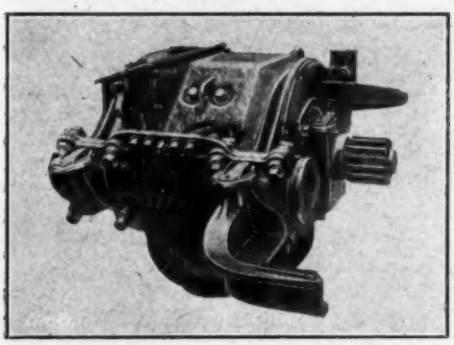

Fig. 1.—The "D.K. 30" Traction Motor.

permeability cast steel, fitted with separately cast armature bearing boxes on either side, which are firmly bolted to the frame. This gives a very rigid construction, and one which facilitates dismantling for inspection, as the armature can be retained in position while the bottom half of the split frame is removed or can be removed with it if necessary. The solid armature bearing boxes are also an effective preventative of oil creepage into the interior of the shell.

The main pole pieces are built up of laminated steel punchings, riveted together, and are interchangeable and fitted with former wound coils; these coils are specially insulated to withstand moisture and high temperature conditions, and are firmly held in position by flat steel springs, by means of which any shrinkage of the coil is automatically taken up. The interpoles are solid steel, with field coils clamped into position by screws.

The armature is of the firm's standard construction, special air ducts being provided in the core for ventilation purposes. To ensure that this ventilation is satisfactory and positive, a double-flow exhaust fan of compact form is fitted to the armature which draws one current of air through the armature laminations, and another over the field coils.

This air enters the motor casing through inlets of considerable area, which are located behind the commutator lid, where they are protected from dust and water, and is discharged through outlets at the pinion end, in a similarly protected position; both the air inlets and outlets are fitted with coarse protective screens, shaped so as not to restrict the volume of air entering or leaving the air ducts. The volume of air and its velocity are such that any dust entering the casing is carried right through and expelled, an operation which the smooth direct air-passages greatly facilitates, as also the fact that no reversal of direction of air current occurs in the motor.

The cooling effect resulting from this positive system of ventilation increases the continuous capacity of the motor to 70 per cent. of the one-hour rated capacity, as compared with a value of only 40 per cent. with the unventilated type of motor.

It is unnecessary to emphasise the value of this feature as it is obvious that in tramway operation the capacity of the

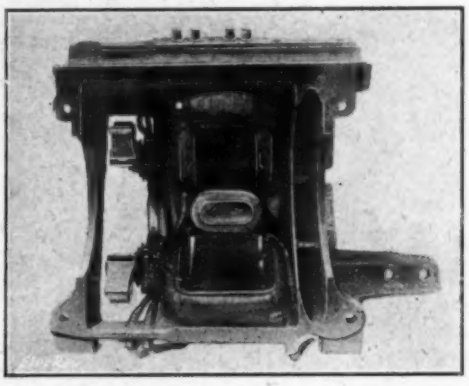

Fig. 2.—Bottom Half of Split Frame, showing Pole Faces.

motor for continuous operation during periods of 8 or 10 hours is far more important than its one-hour rating, and due to the cooler running conditions the life of the insulation is increased, as it is unlikely to suffer from the effects of overheating.

The bearings of the armature as well as those for the axle suspension are lubricated by means of wool waste and horsehair saturated in oil, a special channel being cast in the bearing box for oiling; the motor is also adapted for ring-lubrication, and owing to the oil storage capacity provided, the bearings will operate for long periods without attention.

The motor is fitted with the firm's standard brush gear; the axle is provided with a forged steel pinion cut from the

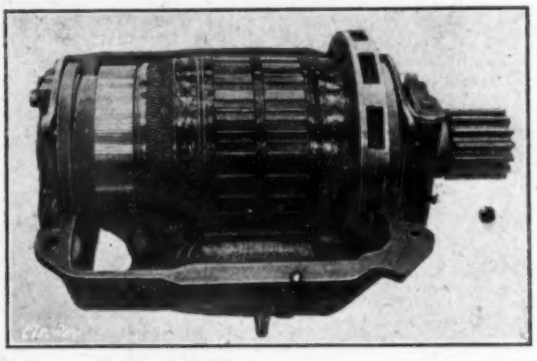

Fig. 3.—Armature, showing Double-flow Exhaust Fan.

solid, which meshes with a cast steel gear wheel, the gearing being enclosed in a malleable iron case supported from the frame.

The "D.K. 30" motor is designed for a narrow (one metre) gauge, and rated at 40-H.P. when operating on 500 volts at a speed of 520 R.P.M.; it is claimed that it represents a great advance on existing designs, even of the ventilated type, both in efficiency and all-round reliability, and is specially adapted for use under the conditions met with in British tramway operation.

Electric Salt Extraction in Norway.—A company, with a capital of 20,000,000 kroner, is about to start the exploitation on a large scale of Prof. Helland Hansen's method for extracting salt from sea-water. It will probably be found expedient to erect several works along the coast, as more electrical energy becomes available. The comparatively large capital is necessary on account of the large plant needed, pumping stations, &c., absorbing the bulk of the power; the production of the salt itself only requires a small amount of energy. Stavanger has been mentioned as likely place for the first factory, and the Glaamfjord for second.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

New Watertight Lantern.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have recently issued a mailing card, No. 676, dealing with their new deep watertight lantern, of which the following is a short description:—The lantern is cast with a deep recess in the top, into which the lampholder fits. The deep cast body and standard well glass make a pleasing, well-balanced combination, and avoid the necessity of stocking extra deep well glasses, which at the present

Fig. 1.—Simplex Watertight Lantern.

time are more difficult to obtain than the standard glasses. This deep-body lantern, fig. 1, used with the firm's new sheet-metal shade, throws the light downwards, and none is wasted by horizontal rays. The inner reflecting surface is white, and if regularly cleaned it is claimed that a better light is given on the ground than with any other lantern on the market. The card will be sent to readers upon request.

New Arora Fires.

Two years ago we recorded the progress made by the Arora Co., of Loughborough, Leicestershire, which started work in May, 1915, in premises which already contained a foundry and engineering workshop; since then the demand for the firm's electric fires has developed so much that the erecting shop has had to be extended to about five times the original floor space, and the output for 1918 is likely to be three times that of 1917. A leaflet which is now being issued describes two new Arora fires: a 4-kw. fire, and

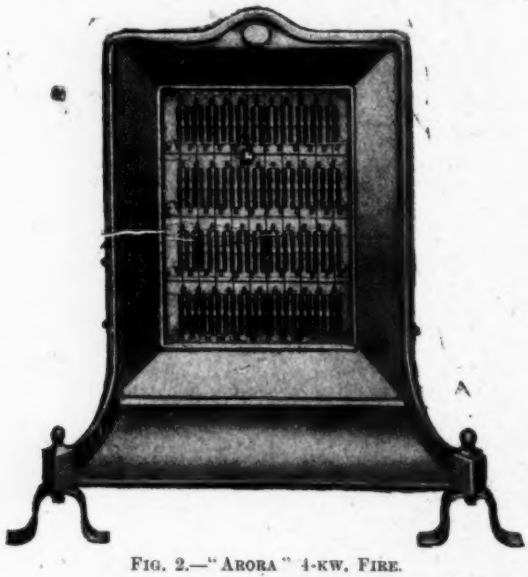

Fig. 2.—"Arora" 4-kw. Fire.

a 1-bar fire, No. 10, the latter being suitable for small rooms and kitchens. We illustrate herewith (fig. 2) the large fire, which resembles the smaller patterns previously made, but is standardised with 1,000-watt bars instead of 750-watt elements, and is controlled by three 10-amp. switches; the fire stands 23½ in. high, and weighs 35 lb. The firebox is interchangeable, and is easily attached to front castings of various finishes. The small No. 10 pattern is reduced to the simplest form, consisting of two strong castings which contain one 750-watt bar. It measures 10¾ × 4½ × 3 in. high, and weighs 7 lb.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,455. "Hammer interrupters for radiotelegraphy." Svenska Aktiebolaget Gasaccumulator. August 19th. (Sweden, September 14th, 1917.)

13,459. "Electric burglar-alarm systems." T. Gunn, Ltd., & H. J. Cribbles. August 19th.

13,473. "Regulators for dynamo-electric machines." Remy Electric Co. August 19th. (U.S.A., July 19th, 1917.)

13,474. "Regulating devices for dynamo-electric machines." Remy Electric Co. August 19th. (U.S.A., August 18th, 1917.)

13,476. "Electrical ignition systems." A. Press. August 19th.

13,477. "Energiser circuits." A. Press. August 19th. (U.S.A., August 15th, 1917.)

13,493. "Combined electric switch and starter panels." M. Pedder and A. Perry. August 20th.

13,499. "Directive wireless telegraphy." E. R. Clarke. August 20th.

13,510. "Signalling on primaries of telephone or telegraph phantom circuits." E. S. Ritter. August 20th.

13,518. "Alternating-current generators." T. F. Wall. August 20th.

13,520. "Combination night-light and electrical heating apparatus." T. G. F. Jorgensen. August 20th. (Norway, August 26th, 1917.)

13,521. "Ignition devices." E. C. R. Marks (Splitdorf Electrical Co.). August 20th.

13,534. "Vibrating decelerating relays." V. Breeze and A. West & Co. August 20th.

13,536. "Method of determining direction of distance sources of electromagnetic wireless radiation." F. Adcock & R. E. Ellis (Adcock). August 20th.

13,539. "Pocket or portable electric lamp." I. Chkliar, W. King (Chkliar & Theodor) and B. Theodor. August 20th.

13,544. "Dynamos for electric arc welding." F. C. Gibbons. August 21st.

13,549. "Electrical fuse distribution box." R. T. Norton & A. C. Robinson. August 21st.

13,578. "Automatic telephone systems." J. H. Taylor. August 21st. Ges. L. M. Ericsson & Co.). August 23rd.

13,589. "Magneto-electric machines for ignition in internal-combustion engines." British L. M. Ericsson Manufacturing Co. & A. Brooks. August 21st.

13,607. "Treating gases and vapours electrically." W. T. Hoofnagle. August 21st.

13,614. "Operating distant devices by electro-magnetic waves." A. G. Bloxam (Russische Akt. Ges. L. M. Ericsson & Co.). August 21st.

13,633. "Apparatus for sending messages in the Morse alphabet." H. O. Andrews & Rodney Engineering Co. August 22nd.

13,642. "Cleaning metals by electrolysis." I. Jascowitz. August 22nd.

13,653. "Electrically-heated balloons." J. W. Meek & F. J. Turquand. August 22nd.

13,691. "Ignition mechanism of internal-combustion engines." W. G. Iain. August 22nd.

13,698. "Electrical device for automatically indicating correct temperature of electrically-heated steel before quenching to obtain correct hardening thereof." H. Alexander, A. Imbery & W. T. Vint. August 22nd.

13,717. "Electric adapters, &c." N. McLean. August 23rd.

13,722. "Trip switches for controlling electric circuits." P. S. Brook and J. A. Hirst. August 23rd.

13,733/4. "Electric heaters." J. R. Quain. August 23rd.

13,752. "Alternating current dynamo-electric machines." British Thomson-Houston Co., F. H. Clough, H. W. Taylor & F. P. Whitaker. August 23rd.

13,756. "Electrical instruments for signalling on railways." F. W. Leake and Tyer & Co. August 23rd.

13,757. "Means for indicating corrections to be applied for deflection or elevation when firing at moving targets." A. G. Bloxam (Russische Akt. Ges. L. M. Ericsson & Co.). August 23rd.

13,758. "Automatic telephone systems." J. H. Taylor. August 21st.

13,767. "Electrical relays." C. B. Harlow. August 23rd.

13,791. "Selecting-switches for automatic telephone systems." Automatic Telephone Manufacturing Co. & J. Savin. August 24th.

13,810. "Electrical synchronising gear for aeroplane guns." N. Penty. August 24th.

PUBLISHED SPECIFICATIONS.

1917.

2,740. Electrostatic machines. D. K. Morris. February 24th, 1917. (117,821.)

5,693. Magnetometers for measuring weak magnetic fields. J. L. Valente de Cruz. April 23rd, 1917. (Cognate application, 7,444/17.) (117,825.)

9,312. Electromagnetic lock-out switch. A. West & Co. and R. P. Bossom. June 28th, 1917. (Cognate application, 13,616/17.) (117,830.)

10,952. Electric diaphragm horns. E. C. R. Marks (Sparks-Withington Co.). July 30th, 1917. (117,838.)

11,289. Self-regulating dynamos. A. H. Midgley and C. A. Vandervell and Co. August 4th, 1917. (117,849.)

11,399. Automatic regulator for electric machines. J. Gehrig. August 8th, 1917. (116,853.)

12,114. Cooling appliances for sparking plugs of internal-combustion engine cylinders. J. Pomeroy & F. L. Varty. August 23rd, 1917. (117,859.)

15,394. Systems of electric transmission. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 23rd, 1917. (117,867.)

16,339. Deposition of metals by electrolysis. M. A. Bolton & A. Walker. November 8th, 1917. (117,872.)

1918.

262. Electrically-operated diaphragm horns. W. H. Petersen and Allmanna Svenska Elektriska Aktiebolaget. January 4th, 1918. (117,884.)

Decimal Coinage.—A Royal Commission has been appointed to consider and report on the question of placing our currency on a decimal basis and as to whether, if a change is advisable, the Decimal Coinage Bill introduced into the House of Lords by Lord Southwark should be adopted. Lord Emmott is chairman. Communications may be addressed to "The Royal Commission on Decimal Coinage," Treasury Chambers, S.W. 1.